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# PSYCHE

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## HOW ODYNERUS SUSPENDS HER EGG

BY CARL G. HARTMAN

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So far as the writer is aware it was he and his sons, Philip and Paul, amateur entomologists, who first witnessed a Eumenid wasp expel her egg and hang it from the ceiling of her nest — or rather suspend it and then expel the egg, for, as a matter of fact, the thread is made first. Dame Fortune was with us further in that the very first time we witnessed the act we had the movie camera set up, loaded with Kodachrome, and so secured a motion picture of oviposition.

For some forty years, on numerous occasions, I have amused myself and bored tolerant friends by attracting certain solitary bees and wasps ("tube fillers") to my window-sill by setting out tubes of various diameters suitable for their occupancy. Trypoxylon and Odynerus were sure to be there, also small bees as well as the larger Megachile, the leaf cutter. The last mentioned proved especially popular with the amateur naturalist. The method most often employed was that well described and figured by Savin (Natural History, 1922). This method consists essentially of screwing together two smooth-faced boards and boring holes of various diameters down the surface of junction. By removing the screws the work of insects could readily be laid bare. Bamboo tubes and even rubber tubing were also set out, but the latter does not favor the survival of the wasp grubs. In vacation time of 1941, however, at Bethlehem, Connecticut, all energies were devoted to watching and photographing the insects as they worked in glass tubes. No better means can be imagined for prying into the insects' domestic activities than by inducing them to live in glass houses! In this the insects proved most cooperative.

It is the object of the present paper to describe the egg-laying of *Odynerus* (*Rygchuum*) *rugosus* (Sauss) = *foraminatus* (Sauss) as observed and photographed by the glass-tube method

Bamboo tubes which served as sheaths for the glass tubes so as to afford the requisite darkness of the interior, were tacked on a tree-trunk or the side of the house or other comfortable shady place, and developments awaited. Light for instantaneous photography was secured by reflecting sunlight on the tube by means of a mirror

The egg is always laid before the prey is captured and the cell stored. Trypoxylon and many others reverse this sequence. The signal for the egg-laying ceremony consists in the wasp's turning around and backing into the tube. Egg laying is the only act for which this orientation is necessary.

After entering the tube the more or less excitable female comes gradually to rest supinely on her wings, with tip of abdomen directed upward close to the mud partition. The rapid breathing movements (air temperature 90° F.) are soon accompanied by another type of movement, a comparatively slow, rhythmic contraction of the abdomen, in which the abdominal segments seem alternately to telescope and evert as the tip of the abdomen is retracted and extended. In the words of the observant young assistants: "She's pumpin' an egg." With each extension of the abdomen the tip comes in contact with the ceiling. Presently a drop of whitish secretion appears and is touched to the ceiling. There it sticks; and as the abdomen is withdrawn a thread is drawn out and instantly hardens, remaining flexible and tough, for subsequent movements of the abdomen do no injury to it.

The abdominal movements continue uninterruptedly until gradually the egg begins to slide out. The motion picture shows the egg free for about one-third of its length when a sudden jump in the film occurs to the point where the egg is two-thirds emerged, the interval marking the time that the camera was being re-wound.

As soon as the egg is free, it is seen to dangle by its thread like a tiny pendulum.

### *Function of the Thread*

On the adaptive significance of the suspensory thread of the Eumenid egg or its possible phylogenetic history, the writer has no contribution to make. Several observations, however, may be cited confirmatory of Ch. Ferton's contention (Collected Works,

1923) that Fabre laid too much stress on the correlation of the well-known liveliness of Eumenid's caterpillars and the alleged delicacy of the Eumenid egg

It is a matter of common observation that the Eumenid prey is seldom stung to death. On opening a nest of Eumenes or Odynerus practically all of the caterpillars respond to stimulation and many move spontaneously. It is not at all a rare occurrence that a caterpillar begins to crawl as soon as set free. One of the scenes in our motion pictures of Eumenes is that of a merry scramble of four or five surviving caterpillars with two large wasp grubs holding on — for this case concerned an exceptional nest in which two eggs had been laid.

Fabre considered the egg much too delicate to stand the jostling of such vivacious prey entombed alive, he states that he was never able to rear grubs from eggs that were disturbed or removed from their original sites. But not so Ferton, who seldom failed under similar circumstances. Indeed, he once dropped an egg with the lively canker worms into a bottle, carried the specimens some miles on horseback, yet reared a wasp from the egg. We have also reared wasps from eggs that had been carried about in the jug nests of Eumenes or in bamboo tubes stored by Odynerus, although these were not handled with any special reference to the force of gravity.

Ferton points out, furthermore, that the cells are usually so tightly packed with caterpillars that the egg must needs be pressed against the wall and not able to dangle freely at all. This can readily be corroborated by opening almost any fully stored cell. If one split a bamboo tube full of caterpillars, it will be seen that the masses of worms literally swell up as the retaining wall is removed.

To these points we are able to add our direct observation on what happens to the egg as viewed through the wall of the glass tube while the insect is at work.

After the egg has been suspended in the depth of the cell, foraging begins. As the caterpillars are brought in they are stuffed with might and main into a closely fitting firm mass at the bottom of the cell. This happens also in smooth-walled glass tubes in which the worker finds only a precarious footing. The egg is always pushed around and often squeezed against the glass or between caterpillars, which are thus thoroughly immobilized by virtue of mutual pressure.

Ferton is of the opinion that the chief value of the suspensory

thread for racial survival lies in the avoidance of contact by the egg with the wet wall of the cell. All predacious wasps seem particular as to the site of attachment of the egg, usually choosing the upper surface of the prey, or, if the egg is laid on the ground, as in the case of certain fly-catchers that feed the prey from day to day, a pebble is chosen to receive the egg. Of interest in this connection is the "transitional" habit of *Rhaphiglossa zethoides*, a solitary Vespid which attaches its egg, not by a thread, but by an elongated end in such a way that the egg projects away from the wall at an angle of about  $45^{\circ}$ . This wasp is of further phylogenetic interest in the use of both wood fiber, after the manner of the social wasps, and mud, which solitary Sphecina as well as Vespina usually employ.

*Summary.* The act of oviposition of *Odynerus rugosus* is here described and the probable function of the suspensory thread of the Eumenid egg is discussed.

## A NEW FUNGUS GROWING ANT FROM MEXICO

BY WILLIAM F. BUREN

Alexandria, Louisiana

*Trachymyrmex smithi*, n. sp.

Worker.

Similar to *T. septentrionalis obscurior* but black in color and with several structural differences

Length about 3.5 to 4.0 mm.

Head, excluding mandibles, a little broader than long, wider behind than in front, with the hind border excised in an obtuse angle, and the sides feebly convex. Head broadest midway between the eyes and posterior corners. Clypeus broadly notched in the middle. Frontal carinae more mesally placed than in many species of *Trachymyrmex*, produced laterally into subtriangular lobes in front, becoming faint behind and fading out before reaching the hind border of the head. Scares surpassing posterior corners of head by about one fourth of their length. All funicular joints longer than broad. Antennal scrobes indistinct behind. Genal carinae curving obliquely mesad past the level of the eyes. No postocular carinae. Eyes hemispherical. A single short blunt spine behind each posterior corner of the head.

Thorax rather robust. Mesoepinotal impression moderately deep. Inferior pronotal spines small and lappet-shaped. Median superior pronotal spines separate and rather blunt. Lateral pronotal spines blunter than in *obscurior*, projecting laterally and curving slightly ventrad toward the tip. Three pairs of spines on the mesonotum. The first pair not as long as the lateral pronotal pair but blunter and more robust, broader at the base than high. The posterior two pairs of mesonotal spines much smaller and somewhat sharper. Epinotal spines slender and sharp. Rows of tubercles run forward on the epinotum from the epinotal spines to form longitudinal carinae, and other rows of tubercles form rather feeble oblique carinae on the pleurae of the epinotum and mesonotum.

Petiole and postpetiole much as in *obscurior* but the petiole is longer, its anterior dorsal face more sloping. Postpetiole notched

behind as in *obscurior*. The tubercles on petiole and postpetiole larger and more spine-like than in *obscurior*.

Lateral ridges and longitudinal depressions on first segment of gaster indistinct or absent.

Mandibles striate and rather shining. All other regions opaque, densely and finely punctate, giving a granular appearance. Tubercles and hooked hairs moderately numerous, about as in *obscurior*. The thoracic spines are abundantly covered with hairs and tubercles. No tubercles on legs, scapes, pronotum anterior to the spines, most pleural regions of the thorax, and venters of pedicel and gaster, although these parts have numerous hooked hairs. Tubercles larger on occipital lobes than on other parts of head, tubercles on vertex and hind portions of antennal scrobes often prolonged into small longitudinal ridges, or connected by ridges to form small longitudinal carinulae. No pubescence except on funiculi.

Color entirely black except for the mandibles, tarsi, and articulations of femora and tibiae, which are brown.

Male and female unknown.

Described from 59 specimens collected November 5 and November 8, 1942, from the same nest in the desert near La Rosa, in the state of Coahuila, Mexico (Elinor Buren, collector). Holotype in the author's collection, paratypes in the author's collection and in the National Museum. The nest was of a simple crater type unlike that of *turrifex* or *septentrionalis*. The ants were extremely slow and sedate in movement even in hot sunlight. They were observed bringing in small green bits which seemed to be pieces of grass. The hard soil prevented excavation.

*T. smithi* seems most closely related to *T. septentrionalis obscurior* Wheeler but the black color, broader, more robust head and thorax, differently shaped thoracic spines, weaker frontal carinae, etc., seem sufficient distinctive characters.

This species is not closely related to *turrifex* which also occurs in northern Mexico (Vallecillo, Nuevo Leon). *T. turrifex* has shorter antennae, a different color, narrower head, differently shaped frontal and genal carinae, tubercles on legs and scapes, etc.

*T. jamaicensis* and its variants often approach or are similar in color to *smithi*, but these forms may be easily distinguished by the three prominent spines or large tubercles on each occipital lobe, the differently shaped head, eyes, thoracic spines, etc.

*T. saussurei*, *arizonensis*, and *desertorum* may all be distin-

guished by their ferruginous color and various differences in shape, spinulation, and tuberculation

I take great pleasure in dedicating this species to an outstanding American myrmecologist, Dr M. R. Smith, of the National Museum

I am indebted to Dr Smith for his kindness in comparing specimens of *T. smithi* with an undescribed species of *Trachymyrmex* from Lower California in his possession

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The secretary of the Cambridge Entomological Club regrets to announce the death of Mr Charles V. Blackburn at Stoneham, Mass , on April 11, 1944, in his 88th year. He was a member of the Club for 41 years, having been elected at the 232nd meeting, December 15, 1903 In 1942 he was elected an honorary member.

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THREE NEW AFRICAN SPECIES OF  
MORDELLID BEETLES

BY EUGENE RAY

Chicago, Illinois

The following descriptions were made from a lot of eleven specimens collected in the Sudan region of Africa by A. P. G. Michelmore and R. C. M. Darling and sent to the writer by Sir Guy A. K. Marshall, Director of the Imperial Institute of Entomology, British Museum (Natural History). The types of the new species hereinafter described are temporarily placed in the Chicago Natural History Museum, while paratypes remain in the collection of the writer.

*Tomoxia abrupta* new species

Form short, sides subparallel, derm generally black, with the following exceptions: anterior and intermediate legs and seven distal segments of antennæ fuscocastaneous; four proximal segments of antennæ, palpi, front, and mesal margin of mandibles castaneous. Body densely covered with fine recumbent pubescence, a solid golden on head and pronotum, black on scutellum, an irregular golden area covering basal third of elytra, enclosing an irregular black area on either side of scutellum near base, an irregular, transverse, golden band behind middle, reaching suture but not middle and connected with basal area by a short sutural line, with intervening and subsequent areas blackish-pubescent; ventral surface blackish-pubescent, except for the following whitish areas: meso- and metasternum, 1st and 2nd abdominal segments (except at apical margin), and third segment along basal margin.

(♀). Antennæ 1.4 mm long, reaching metasternum; segments 1 and 2 equal; 3 distinctly longer than 4, latter broadest at apex; 5 as long as 3, but broader; 6-10 strongly serrate, as broad as long; 11 one-half longer than 10, inner margin and apex rounded, broadest at middle. Terminal segment of maxillary palpi enlarged, with form of a scalene triangle, sides and angles all strongly rounded, mesal margin thickest, divided longitudinally,

with a concave, elongate depression between the edges. Head strongly flattened antero-posteriorly, front, clypeus, and vertex forming a straight line. Eyes reaching occiput.

Pronotum distinctly broader than long ( $2.0 \times 1.8$  mm.), anterior margin and sides rounded, base arcuate, midbasal lobe short, broad, subtruncate. Scutellum subquadrate, sides but slightly angular, apical margin truncate.

Elytra short, but four-tenths longer than broad ( $3.2 \times 2.0$  mm.), sides attenuate to apex, apices individually rounded. Anal style short, thick, truncate at apex, but one-half longer than hypopygium ( $1.5 \times 1.0$  mm.). Posterior tarsal claws with five teeth, two premedian, the first very small, the other distinct; three postmedian, first larger than any other except terminal one, second small, third terminal.

(♂) The males are darker, the castaneous parts of the female being almost picous in this sex. The elytral markings are more restricted, the posterior band being curved anteriorly at the suture and lateral margins.

Length: to apices of elytra, 3.3–5 mm.; to tip of anal style, 4.3–6.5 mm.

Five specimens: male *type* and two male paratypes, Wady Madu, N. E. Darfur, July 25, 1930, at flowers of *Premna resinosa* (Michelmores); one male paratype, Plain below J. Kaboija, J. Midob, N. E. Darfur, August 7, 1930, common on leaves and flowers of large succulent grasses (Michelmores), one female paratype, Duani, wilderness of Toganoy, N. E. Darfur, August 12, 1930, on foliage of *Grewia flavescens* (Michelmores).

This species may easily be separated from the only other African member of the genus, *T. robusta* Pic (Rev. zool. bot. afr. 21, 1931, p. 45), by the wholly different pubescent markings, the unicolored abdomen and legs, the bicolored antennæ, and the larger size. Mr. Pic's short diagnosis unfortunately does not permit a more adequate comparison.

#### *Mordellistena sudaniensis* new species

Form elongate, sides subparallel, derm generally black, with the following exceptions: anterior and intermediate legs, front, palpi, and three basal antennal segments flavocastaneous; posterior legs fuscocastaneous. Body densely covered with fine, recumbent, cinereous pubescence and minute, closely-placed tubercles.

Antennæ 0.9 mm long, reaching metasternum, segments 3-4 equal in length, the latter a little broader; 5-10 each one-third longer than 4 and almost twice as broad as 3, broadest subapically, 11 one-half longer than 10, sides and apex rounded, broadest medially. Terminal segment of maxillary palpi enlarged, slender, three times as long as broad at widest point, ovoid, outer side somewhat less rounded than inner margin, broadest on apical half.

Pronotum as long as broad (0.8 mm), sides and apex rounded, base arcuate, midbasal lobe short, subtruncate.

Elytra two and three-fourths times as long as broad ( $2.2 \times 0.8$  mm), sides subparallel to within a fourth of apex, then strongly curved, apices individually rounded. Anterior and intermediate tarsi longer than their tibiae. Posterior tibiae with two strong ridges (excluding subapical one), the anterior extending obliquely entirely across outer face, basitarsi with three, second segment with two oblique ridges. Anal style short, subtruncate at apex, but twice length of hypopygium ( $0.7 \times 0.35$  mm).

Length: to apices of elytra, 3 mm, to tip of anal style, 3.7 mm.

Four specimens. Type, male, and two female paratypes, El Wuz, September 17, 1931, at light (Darling), a male paratype, Plain below J. Kaboija, J. Midob, N. E. Darfur, August 7, 1930, common on leaves of large succulent grasses (Michelmores).

This species is allied to *diffinis* Maklin (Acta Soc. Sci. Fenn. 10, 1875, p. 586), but may easily be separated by the larger size, the much shorter anal style, the lighter appendages, the shorter and broader pronotum and elytra, and the elongate anterior ridge of the posterior tibiae.

#### *Mordellistena darfurensis* new species

Form elongate, sides subparallel; head, mouth parts, antennæ (outer segments darker), pronotum, and anterior and intermediate legs, flavo- or fuscocastaneous, thorax sometimes with an indefinite dorsal cloud; meso- and metasternum, abdomen, posterior legs, and elytra, black. Body densely covered with fine, recumbent, flavocinereous pubescence.

Antennæ 1 mm long, reaching metasternum; segments 3-4 equal; 5-10 each one-third longer than 4 and considerably broader, broadest subapically; 11 one-third longer than 4 and considerably broader; 11 one-third longer than 10, sides and apex rounded, broadest medially. Terminal segment of maxil-

lary palpi enlarged, slender, two and one-half times as long as broad, with the form of a scalene triangle, outer edge straight, other margins and angles rounded, broadest at a postmedian point

Pronotum as long as broad (1 mm), sides and angles broadly rounded, basal angles obtuse, base arcuate, midbasal lobe short, subtruncate.

Elytra two and seven-tenths times as long as broad ( $2.7 \times 1$  mm), sides subparallel on basal half, thence distinctly curved to apex, apices individually rounded. Anterior and intermediate tarsi longer than their tibiae. Posterior tibiae with three strong, equal ridges (excluding subapical one); basitarsi with three (one specimen with a rudimentary fourth), second segment with two oblique ridges. Anal style moderately long, attenuate, subtruncate at apex, two and one-third times length of apical ventral segment ( $1.4 \times 0.6$  mm)

Length to apices of elytra, 3.7 mm, to tip of anal style, 5.1 mm

Two specimens. Type from Plain below J Kaboiija, J Midob, N E Darfur, August 7, 1930, on leaves and flowers of large succulent grasses, paratype from N E Darfur, August 5-13, 1930 (Michelmore)

This species may be separated from its closest ally, *atriventris* Pic (Rev zool bot afr 21, 1931, p 47), by the flavocastaneous head, the black elytra, the flavocinereous pubescence, the unicolorous legs, the shorter anal style and the larger size. The short description of *atriventris* indicates that the posterior tarsi of his type specimen may be missing. Other differences probably exist, but Pic's short description deals chiefly with color — the antennae and maxillary palpi are not mentioned.

FURTHER STUDIES OF THE TABANIDÆ  
OF TRINIDAD, B. W. I.

By J. BEQUAERT

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Boston, Mass.

The publication of my list of Trinidad Tabanidæ a few years ago (1940, Bull. Ent. Res., 30, pp. 447-453) induced several entomologists to a more intensive study of these flies. Dr. E. McC. Callan submitted for identification two lots, including all specimens in the Department of Entomology of the Imperial College of Tropical Agriculture. More recently Dr. Raymond C. Shannon, of the International Health Division, The Rockefeller Foundation, forwarded to me many specimens obtained by him and his associates in the course of their studies on malaria. The result is most gratifying and has induced me to draw up a revised list of the species known from the island. This was the more necessary because recent careful work on the Panamanian fauna by Dr. G. B. Fairchild has resulted in certain corrected identifications and names. Some of these changes were decided upon in personal discussion with Dr. Fairchild, and most of them have since been published by him. None of the information given in my earlier paper is repeated here, unless it called for correction.

The number of known Trinidad Tabanidæ has risen now from 23 to 31 species, 9 species being added. One of the species of the earlier list (*Tabanus ochrophilus*) was dropped, as the specimen on which the record was based is not now available for study and was no doubt misidentified. The following changes in nomenclature were made. The species formerly listed as *Chrysops auroguttata* is now called *Chrysops pallidefemorata* Kröber. *Stibasoma dyridophorum* becomes a synonym of *S. mallophoroides*. The older name *T. limonus* is applied to the species formerly called *T. viridis*. In accordance with G. B. Fairchild's recent work, *T. amplifrons* is used for the species I called *T. trilineatus* and *T. vittiger* subsp. *guatemalanus* for

the females formerly called *T. carneus*; while *T. appendiculatus* is considered a synonym of *T. lineola* var. *carneus*.

Two species of *Tabanidæ* are now known from Tobago: *Tabanus amplifrons* and *T. leucaspis*, both common in Trinidad.

In my earlier paper a brief comparison was drawn between the tabanid faunæ of Trinidad, the Antilles, and continental South America. This was somewhat amplified in my monograph of the Tabanidæ of the Antilles (1940, Rev. de Entomologia, 11, p. 271-272). The conclusions reached at the time are merely confirmed by recent additions. The purely South American character of the Trinidad tabanid fauna remains beyond dispute. All nine genera of the revised list are found on the continent. This is true also of the nine subgenera here included in the genus *Tabanus*, some of these groups being given generic rank by recent authors (*Stenotabanus*, *Leucotabanus*, *Chlorotabanus*, etc.) The 31 species likewise all occur on the American mainland, where most of them are widely distributed. On the other hand only four of the nine Trinidad genera are represented in the Antilles (*Chrysops*, *Lepiselaga*, *Dichelacera*, *Tabanus*); while of the nine subgenera of *Tabanus*, five occur in Trinidad as well as in the Antilles (*Chelotabanus*, *Bellardia*, *Chlorotabanus*, *Macrocornus* and *Stenotabanus*). Of the 31 Trinidad species, only five are definitely known from the Antilles. *Chrysops variegata*, *Lepiselaga crassipes*, *Tabanus hookeri*, *T. vittiger* (= *T. truquii* of my Antillean monograph) and *T. lineola*. (*T. ferrifer* has been recorded doubtfully from Barbados). These five species are widely distributed throughout tropical America, *T. lineola* occurring even in the Nearctic Region

1. *Chrysops variegata* (Degeer).
2. *Chrysops tristis* (Fabricius).
3. *Chrysops fulviceps* Walker (= *C. aurofasciatus* Kröber).
4. *Chrysops pallidefemorata* Kröber (= *C. auroguttatus* var. *pallidefemoratus* Kröber, 1930, Zoolog. Anzeiger, 90, p. 72, figs. 9-10; ♀; Trinidad).

Lezard Swamp, female (R. C. Shannon); Caroni Swamp, female (R. C. Shannon).

These two specimens agree with Kröber's figures of the head, antenna (partly drawn) and wing pattern of var. *pallidefemoratus*, not with those of his typical *auroguttatus* (*Ibid.*, p. 71,

figs. 6 and 8) The second tergite of the abdomen bears a small median apical pale spot.

A renewed study of these specimens and of some other material in our collections has led me to separate *pallidefemorata* as a distinct species. The frons is considerably broader than in *auroguttata*, the second antennal segment is relatively shorter and the first somewhat swollen; the hyaline area in the fourth and fifth posterior cells touches the discal cell; there is no trace of a hyaline spot near the base in the first submarginal cell; and the apical dark streak of the wing is more deeply notched at the base by the hyaline area, so that its apical portion appears widened. The three females from Quintana Roo, Mexico, which I called *C. incisa* in my paper on the Yucatan Tabanidæ (1932, Jl. New York Ent. Soc., 39, for 1931, p. 535) were really *C. pallidefemorata*, so that the species appears to be widely distributed.

The specimens which I listed from Trinidad under *C. auroguttata* in my earlier paper (1940, p. 448) are not now available, so that I am unable to place them under either that species or *C. pallidefemorata*. There is even a possibility that the Trinidad cotype of *auroguttata* was really a *pallidefemorata* and that Kröber's drawings of *auroguttata* were made from the Colombia cotype (both cotypes are at the British Museum). For this reason I omit provisionally the true *auroguttata* from the Trinidad list. The female from Costa Rica (Carillo), which I reported in 1940, was Kröber's true *auroguttata* and this is also true of the Panama records published by Pechuman (1937, Rev. de Entomologia, 7, p. 136) as *C. auroguttata* var. *pallidefemorata*, and by G. B. Fairchild (1942, Proc. Ent. Soc. Washington, 44, p. 4) as *C. incisa*.

Whether *Chrysops incisus* Macquart (1845, Mém. Soc. R. Sci. Agric. Arts Lille, for 1844, p. 172, Pl. IV, figs. 12-12a; ♀; "New Grenada") was *C. auroguttata* Kröber, *C. pallidefemorata* Kröber or some other species (? *melæna* Hine) appears impossible to decide, unless Macquart's type could be found. The description is vague (the yellow stripes on the sides of the mesonotum are not mentioned) and the drawings are too crude to be reliable.

##### 5. *Chrysops bulbicornis* Ad. Lutz.

St. Augustine, 2 females (W. Cook; one of the specimens had

been named *C. læta*, a species not known from Trinidad); St. Augustine, male, allotype (A. M. Adamson); Penal, female (R. C. Shannon); also 3 females from Trinidad, without more definite locality (Stanton Crawford). The species also occurs in Bolivia (Monte S. Pablo).

The markings of body and wings are somewhat as in *C. læta* (Fabricius); but *C. bulbicornis* is readily recognized by the conspicuously swollen first antennal segment and the prominent, conical callosities of the face. In addition, the female has rows of lateral spots on tergites 3 to 6, which tend to fuse into lateral stripes, and the apical black streak of the wing fills the marginal cell completely (the hyaline area not crossing the second longitudinal vein).

*Male* (undescribed). Antennæ as in female, the first segment conspicuously swollen, pear-shaped, both in profile and from above; facial callosities very prominent, cone-shaped, eyes broadly contiguous. Head, including palpi and first two antennal segments, honey-yellow (third segment lacking). Thorax black, covered with black and gray hairs; scutellum and pleura slightly brownish; mesonotum on each side with a prominent yellow stripe. Legs mostly honey-yellow, with black pile; coxæ more brownish. Abdomen brownish-black; dorsum narrowly golden-yellow along extreme sides, with a median row of small, triangular yellow spots on tergites 2 to 5 (more rounded off on tergite 2) and small marginal lateral spots on tergites 3 to 5 (free from the median spot on tergites 3 and 4; narrowly connected on tergite 5). Wing much as in the male of *C. læta* (see Kröber, 1925, Konowia, 4, Pl. III), but apical black streak filling entire marginal cell and anal cell without distinct hyaline streak (though with a slightly paler area). Length, 7 mm.; of wing, 6.5 mm.

6. *Esenbeckia prasiniventris* (Macquart).

St. Augustine, female, the prey of a bembicid wasp, *Rubrica surinamensis* (Degeer) (E. McC. Callan); Maraval, female (Imper. Coll. Trop. Agric.).

7. *Lepiselaga crassipes* (Fabricius).

Pt Fortia, female (R. C. Shannon).

Widely distributed in the Greater Antilles, Central and South America.



8. *Selasoma tibiale* (Wiedemann)9. *Stibasoma fulvohirtum* (Wiedemann).

Balandra Bay, female (W. Cook); Brasso, female, biting man (E. McC. Callan); Cumato, female (R. C. Shannon); Point Gourde, female, biting man (E. McC. Callan); Rio Claro, female (R. C. Shannon).

10. *Stibasoma mallophoroides* (Walker) (= *Stibasoma dyridophorum* Knab).

Balandra, female (E. McC. Callan)

Hine, who examined the type of Walker's species at the British Museum, wrote in his manuscript notes: "Type ♀ very much like *S. dyridophorum* Knab; wings almost exactly the same; the discal spot is hyaline in *mallophoroides* and extends into second basal cell, as is the case in Knab's species. It would seem that the variation known to exist in this genus would bring the two together." This synonymy was accepted by me in 1940 (Rev. de Entomologia, 11, p. 272). *S. mallophoroides* was described from the Amazon region, Brazil.

11. *Dichelacera ochracea* Hine.

Valencia, 2 females, biting man (E. McC. Callan)

12. *Tabanus* (*Chelotabanus*) *discifer* Walker, 1850 (= *Tabanus albomaculatus* Walker, 1854).

Arima, female (E. McC. Callan); Rio Claro, female (E. McC. Callan); Tamano, female (R. C. Shannon).

The species is known also from Brazil (Pará; San Alberto on the Rio Branco in the State of Amazonas), Dutch Guiana and Venezuela. *T. discifer* was based on the female, *T. albomaculatus* on the male. Kröber (1931, Zool. Anzeig., 96, p. 53) reported it from Trinidad and recognized that *discifer* and *albomaculatus* were the two sexes of one species. I was inclined at one time to regard *Tabanus guttigaster* Kröber (1934) (= *T. guttiventris* Kröber, 1929) as the same species and used that name in my paper on Antillean Tabanidæ (1940, Rev. de Entomologia, 11, p. 272); but this synonymy is uncertain and *T. discifer* is, in any case, the older valid name.

13. *Tabanus* (*Chelotabanus*) *ferriker* Walker.

St. Augustine, many females and males (J. T. Gonzalves; A. C. Salazar; E. McC. Callan; A. M. Adamson; Ruth O'Connor; M. D. French-Mullen; D. K. Kevan); also one female

as prey of the bembecid wasp, *Rubrica surinamensis* (Degeer). El Dorado Village, female (M. V. Beattie; named *T. ferrifer* by the late Major E. E. Austen); Nariva Swamp, female (R. C. Shannon); Mundo Nuevo, female (R. C. Shannon); Tamano, female (R. C. Shannon), Siparia, female (R. C. Shannon).

According to Dr. McC. Callan, this is one of the commonest horseflies at St. Augustine, the males being found in ones and twos sitting in sunny places from about 8 A.M. to 4 P.M.

14. *Tabanus* (*Bellardia*) *xipe* Kröber.

St Augustine, male, October 22, 1937 (A. M. Adamson); Tamano, female (R. C. Shannon)

*Male* (undescribed). — Differs from the male of *T. ferrifer* in size, extent of the velvety-black spot of the scutellum, markings of abdomen, color of wings, presence of a long appendix at the fork of the third longitudinal vein, and shape of antennæ. In all these characters it agrees with the female of *xipe*. The eyes are entirely bare and divided into an upper zone of enlarged and a lower zone of small facets.

Dr. Shannon sketched the eye of the female as purple with three green cross-bands, the upper one rather broad but short, the lower one very broad and somewhat narrowed outwardly, the middle one much narrower than the others and somewhat wavy

According to G. B. Fairchild (1942, *Psyche*, 49, p. 8) *Lophotabanus* Szilády (1926) is not subgenerically separable from *Bellardia* Rondani (1863), an opinion with which I concur.

15. *Tabanus* (*Phæotabanus*) *semiflavus* Kröber.

Princes Town, female (R. C. Shannon).

This specimen agrees with two females I have seen from Brazil (Curralinho, State of Pará). The species was first described from Venezuela.

16. *Tabanus* (*Chlorotabanus*) *mexicanus* Linnæus.

Tamano, female (R. C. Shannon).

17. *Tabanus* (*Cryptotylus*) *unicolor* Wiedemann.

Mayaro, female (D. K. Kevan); Tamano, 2 females (R. C. Shannon).

18. *Tabanus* (*Cryptotylus*) *limonus* Townsend (= *Ommallia viridis* Enderlein).

G. B. Fairchild (1940, *Rev. de Entomologia*, 11, pp. 720-

722) established what appears to be the correct synonymy of this species. It is known at present from Mexico, Guatemala, Honduras, Panama, Colombia, Trinidad and northern Brazil.

At one time I referred the Trinidad specimens to *Tabanus luteoflavus* Bellardi (see J. Bequaert, 1940, Rev. de Entomologia, 11, p. 272); but this was erroneous. As for the green male from Paraguay which I mentioned at the close of the discussion of *T. viridis*, it has now been recognized as that of *Tabanus (Cryptotylus) princeps* Brèthes.

19. *Tabanus (Leucotabanus) leucaspis* Wiedemann

Princes Town, female (R. C. Shannon); Saut d'Eau Bay, female, biting man (E. McC. Callan); St. Augustine, 2 females (Ruth O'Connor); Tacarigua, several females (T. H. Khan); Tamano, female (A. M. Adamson); Maracas Valley, female (M. V. Beattie). Other females merely labeled Trinidad (Stanston Crawford).

A common species in Trinidad I have also seen one female from Speyside, Tobago (biting man) (E. McC. Callan).

20. *Tabanus (Macrocornus) sorbillans* Wiedemann

St. Augustine, 4 females (A. M. Adamson; E. McC. Callan) and 2 males (Ruth O'Connor); Tamano, female (R. C. Shannon).

According to a sketch by Dr. Shannon, the eye of the female is purple with 2 rather narrow green cross-bands in life.

21. *Tabanus (Stenotabanus) maculifrons* Hine.

Blanchisseuse, female (R. C. Shannon).

This remarkable little horsefly was originally described from Guatemala (1907, Ohio Naturalist, 8, p. 222; ♀). I have taken a female in Colombia (Caney River near Restrepo, Int. Meta) and G. B. Fairchild found it in Panama. The eye, which I observed in life and which was also sketched by Dr. Shannon, is pale purplish with two moderately broad, unconnected bluish-green cross-bands: one shorter, starting from the frontal callus; the other in the lower third, curved upward at the outer end.

22. *Tabanus (Neotabanus) hookeri* Knab.

St. Augustine, several females (D. J. Billes; E. McC. Callan; D. K. Kevan); also one female as prey of *Rubrica surinamensis* (Degeer) and one male as prey of *Stictia signata* (Linnaeus) (E. McC. Callan); El Dorado Village, female (M. V. Beattie).

23. *Tabanus* (*Neotabanus*) *johannesi* Fairchild (1942, Ann. Ent. Soc. America, 35, p. 164, pl. 1, fig. 6; ♀ ♂).

Nariva Swamp, female (R. C. Shannon).

This specimen was compared with a paratype from Brazil. The species is known also from Paraguay.

24. *Tabanus* (*Neotabanus*) *amplifrons* Kröber (= *Tabanus trilineatus* J. Bequaert, 1940, not of Latreille).

St. Augustine, several females and males, one male taken at light (E. McC. Callan; A. M. Adamson; P. C. Atteck). Tamano, female (R. C. Shannon); Toco, 2 males (R. C. Shannon); El Dorado Village, 2 males (M. V. Beattie); San Fernando, male (C. B. Williams).

It is the species which I called *T. trilineatus* in my 1940 paper. As shown by G. B. Fairchild (1942, Ann. Ent. Soc. America, 35, p. 178), Latreille's *T. trilineatus* appears to be unrecognizable. *T. amplifrons* is known also from Texas, Guatemala, Panama, Colombia, Venezuela and the Amazon Basin of Brazil. In Trinidad it is one of the most common horseflies. According to Dr. E. McC. Callan, the males are often observed in numbers, sometimes even in hundreds, flying and hovering over roadways from about 6 A.M. to 9 A.M.

25. *Tabanus* (*Neotabanus*) *vittiger* var. *guatemalanus* Hine (= *Tabanus carneus* J. Bequaert, 1940; not of Bellardi)

Moruga, female (R. C. Shannon). The females from Trinidad and Siparia, Trinidad, referred to *T. carneus* in my 1940 paper were *guatemalanus*; but the Trinidad male of *carneus* was that of *T. lineola* var. *carneus*.

The var. *guatemalanus* is widely distributed in Central and northern South America.

In a former paper (1940, Rev. de Entomologia, 11, pp. 272 and 352), I identified *T. vittiger* Thomson (1868) with *Tabanus truquii* Bellardi (1859); but Dr. G. B. Fairchild does not agree with this. He regards Bellardi's species as unrecognizable, although possibly the same as *Tabanus amplifrons* Kröber. He also treats the Antillean specimens of *T. vittiger* as a distinct race, which he calls subsp. *caymanicus* (1942, Ann. Ent. Soc. America, 35, p. 180); but the distinction between *guatemalanus* and *caymanicus* seems to be too finely drawn and based mainly on distributional data, not on reliable characters.

26. *Tabanus* (*Neotabanus*) *angustivitta* Kröber.

Nariva Swamp, female (R. C. Shannon).

G. B. Fairchild saw this species from Mexico, Guatemala, Panama, Colombia, Venezuela, British Guiana, Brazil, Ecuador, Peru, Paraguay and northern Argentina.

27. *Tabanus* (*Neotabanus*) *fumatipennis* Kröber.

G. B. Fairchild, who discusses this species at some length (1942, Ann. Ent. Soc. America, 35, p. 162), saw specimens from Trinidad, as well as from Costa Rica, Panama, Brazil and British Guiana.

28. *Tabanus* (*Neotabanus*) *lineola* var. *carneus* Bellardi (= *Tabanus appendiculatus* Hine).

Yarra River, male (R. C. Shannon); Rio Claro, female, biting mule (E. McC. Callan); St. Augustine, female, prey of *Rubrica surinamensis* (Degeer) (E. McC. Callan); Maracas Bay, female (P. C. Atteck); Mayaro, female (D. K. Kevan). The specimens from Port of Spain and St. Augustine, listed as *T. appendiculatus* in my 1940 paper, were also *T. lineola* var. *carneus*.

The var. *carneus* is a common horsefly in Trinidad. It occurs over most of the Neotropical Region, from Mexico to Paraguay and southern Brazil. No other form of *T. lineola* is known thus far from Trinidad.

*Tabanus ochrophilus* of my 1940 paper is omitted here. It is extremely doubtful that the specimen I saw from Trinidad (not now available for study) was Ad. Lutz's species, which was perhaps only a variant of *T. lineola* var. *carneus*, as suggested by G. B. Fairchild (1942, Ann. Ent. Soc. America, 35, p. 175).

The difficult group of trivittate American species, grouped under *Neotabanus*, has recently been revised by G. B. Fairchild and his conclusions are here accepted. The following key of the seven forms definitely known from Trinidad will replace what I wrote in 1940 (Bull. Ent. Res., 30, pp. 452-453).

- |  |   |
|--|---|
| 1 Subcallus bare and shiny in both sexes   | 2 |
| Subcallus pollinose and dull in both sexes   | 3 |
| 2. Subcallus honey-yellow Wing hyaline Mid-dorsal stripe of a series of triangles; lateral stripes broken up into oblique spots Female frons about three times as high as wide, slightly narrowed below Male upper two-thirds of eye hairy and with the facets much larger than those of lower third Length, 9 to 12 mm. |   |
| <i>T. hookeri</i>  |   |
| Subcallus dark brown to black Wing slightly smoky Mid-dorsal stripe of narrow truncate triangles, lateral stripes of a series of short streaks in line   |   |

- Female frons at least five times as high as greatest width, slightly narrowed below. Length, 9 to 12 mm (Male unknown) *T. fumatipennis*
- 3 Female frons less than three times as high as wide and nearly parallel-sided, frontal callus at least as wide as high and nearly as wide as frons. Lateral stripes decidedly step-like. Wing hyaline. 4
- Female frons at least three times as high as wide (usually much higher), in doubtful cases narrowed below, frontal callus as high as wide or higher and narrower than frons. Lateral stripes usually regular. Fore coxae and most femora largely pale or yellowish. 5
- 4 Fore coxae and most femora largely black. Scutellum black. Mid-dorsal stripe a slender even line. Female frontal callus dark brown to black. Male upper half of eye hairy, but with the facets only slightly larger than those of lower half (the line of demarcation between the two types not clearly defined). Length, 11 mm. *T. johannesi*.
- Female fore coxae and most femora pale, scutellum reddish, mid-dorsal stripe a series of contiguous triangles, frontal callus yellowish-brown. Length, 11 to 14 mm (Male unknown) *T. angustivitta*
- 5 Grayish, abdominal stripes broad and quite even, covered with chalky-white hair. Wing hyaline. Female frons nearly parallel-sided, frontal callus brownish, only slightly higher than wide. Male upper half of eye hairy, but with the facets only slightly larger than those of lower half (the two areas not clearly defined). Length, 12 to 15 mm. *T. amplifrons*
- Grayish to yellowish-brown, abdominal stripes covered with grayish-white or yellowish hair. Female frons narrowed below, frontal callus usually decidedly higher than wide. 6
- 6 Wing hyaline. Female frons somewhat less than four times as high as greatest width, frontal callus large, yellowish-brown. Male upper two-thirds of eye hairy and with the facets much larger than those of lower third. Length, 12 to 14 mm. *T. vittiger* var. *guatemalanus*
- Wing somewhat clouded, at least along the veins. Female frons at least four times as high as greatest width, frontal callus rather small, dark brown to black. Male upper two-thirds of eye bare, but with the facets much larger than those of lower third. Length, 12 to 14 mm. *T. lineola* var. *carneus*

## 29. *Diachlorus scutellatus* Macquart.

Trinidad, without more definite locality, female (W. Ulrich). This insect was sent to the U. S. Nat. Mus. and determined by Dr. Alan Stone, who sent it to me for study. The species is known also from French Guiana, British Guiana and Brazil.

## 30. *Diachlorus curvipes* (Fabricius)

Nariva Swamp, female (R. C. Shannon). The species is known with certainty from Panama, Colombia (Muzo, Dept. Boyaca), British Guiana, French Guiana, Venezuela, and Brazil. Surcouf's citation of "Uruguay" was an error for Paraguay; but the occurrence in Paraguay is doubtful.

## 31. *Acanthocera marginalis* Walker.

Diego Martin, female (D. J. Billes); Morne Bleu, 2,700 ft. female, biting man (E. McC. Callan); Talparo, female, biting man (E. McC. Callan).

STUDIES ON SYRPHID FLIES IN THE MUSEUM OF  
COMPARATIVE ZOOLOGY<sup>1</sup>

BY FRANK M. HULL

University of Mississippi

This study presents the descriptions of additional new species of Syrphid flies in the collections of the Museum of Comparative Zoology of Harvard University and represents a continuation of earlier studies. Again I wish to thank Professor Nathan Banks for facilities of study extended to me.

*Syrphus graptus* n. sp.

Male. Length 11.5 mm., wing 10.6 mm. *Head*: eyes bare, touching for a considerable distance; the middle of the posterior margins are gently excavated, the vertical triangle is brownish-yellow pollinose, the occipital pile wholly golden yellow; the front, face and cheeks are pale yellow, the upper face and remainder of face except the broad round central tubercle are covered with dense, golden pollen, more shining upon the face than upon the front. There is also on the front a large, circular, polished, shining bare area, from this area there runs upward a vertical, slender, brownish streak, not however, reaching to the point of contact with the eyes. Just above each antenna is a conspicuous shining black spot. Antennæ wholly pale orange, the base of the arista concolorous, its rather long, apical three-fifths black. Pile of front long, erect and like that of the face pale and confined to a pollinose area. *Thorax*: dark, shining golden-

<sup>1</sup> Published with the aid of a grant from the Museum of Comparative Zoology at Harvard College. Earlier articles in this series, dealing with the Syrphids in the Museum of Comparative Zoology, are as follows:

- I. New Species of Exotic Syrphid Flies. *Psyche*, xlv, pp. 12-31, pl. 2 (1937).
- II. Descriptions of Some New Species of Syrphidæ. *Psyche*, xlviii, pp. 149-164, plate x (1941).
- III. Some Flies of the Genus *Volucella*. *Proc. New England Zool. Club*, vol. xix, pp. 93-98 (1942).
- IV. Some Flies of the Genus *Mesogramma*. *Proc. New England Zool. Club*, vol. xx, pp. 17-24 (1942).
- V. New Species of Syrphidæ from the Neotropical Region. *Psyche*, xlix, pp. 84-107 (1943).

brown with still darker vittæ as follows a pair of narrowly separated, median vittæ slightly diverging posteriorly, the posterior ends pointed but rounded on the medial surface, running nearly half-way down that part of the mesonotum behind the suture, moreover, rather widely separated from the median pair, is the outlying pair of wider vittæ, narrowly interrupted at the suture, their posterior section of which is wide but which becomes slender before it stops almost at the scutellum. Between each of the vittæ and narrowly enclosing them even at their posterior ends and including the whole of the outer lateral margin of the thorax the area is covered with light yellowish-brown, almost golden pollen, thus a large, broad, posterior semicircle lying in front of the scutellum is left bare. Pile of dorsum of the thorax and of scutellum and of pleuræ quite erect, wholly pale with a shining silky yellow luster, it is especially long just before the mesonotal suture on the mesopleuræ and the scutellum. *Abdomen.* elongate, slenderly oval, widest at the end of the third segment, very little less wide basally or at the end of the fourth segment, its greatest width not quite equal to that of the thorax, second and third segments a little longer than the fourth and fifth, fourth segment as long as its own basal width, the fifth segment is a truncated equilateral triangle. Abdomen shallowly convex, non emarginate with the ground color wholly a light rusty red or orange-brown, largely opaque but more shining on the posterior margins and on the narrow basal margins of at least the posterior segments. There is a conspicuous though not wide, transverse, uniform black band across the posterior margin of the second segment and another one about the same width similarly placed on the third segment. On the fourth segment there is a quite subapical, transverse fascia narrow towards the middle, as it nears the midline turning sharply upward as a sharp-pointed wedge of black that reaches quite to the midpoint, on its outer lateral point it turns down sharply to reach the posterior corners of the segment. On the anterior part of the fourth segment some distance from the base there is a slightly oblique slender fascia, its inner end pointed and directed towards the midline of the base, towards the base the inner ends are separated by three times their width. On the anterior half of the third segment about the same distance from the base, are a similar pair of slightly oblique stripes separated by less than twice their width. *Legs:* almost wholly light yellow, the hind tibiæ and tarsi brownish-yellow due perhaps to



the fact that their pile is dark brown whereas elsewhere, except upon the apical two-fifths of the hind femora, the pile is pale. *Wings*: elongate, nearly hyaline, whole of the stigmal cell light brown, the sinuosity of the third vein very slight, the subapical cross vein long, nearly straight, sharply though slightly bent back a short distance from its apex.

Holotype. No. 23796, one male, Sozan, Formosa, June 30, 1934. L. Grissett collector

*Syrphus ochreolinea* n. sp.

Related to *orientalis* H. B. from which it differs in abdominal pattern, etc.

Female Length 7.5 mm, wing 7.5 mm. *Head*: shining metallic black over the vertex, the upper third of the occiput black with brassy-brown pubescence, the lower part greyish white pollinose, all of the occipital pile is long and yellowish white. The front is shallowly concave with a broad band of greyish-brown pollen across the middle which is from either side directed a little diagonally downwards. The band is of uniform width on a shining black background. Face shining black with a yellowish-brown, inverted V running from base of antennæ towards the eye margins, ending opposite the tubercle, its margins diffuse. The whole of the face except the prominent tubercle is whitish pubescent; the shining black cheeks are also whitish pubescent. Pile of face almost wholly pale, with a few black hairs along the eye margins on the upper part of the face, the pile of the front and vertex is long, erect and black. Eyes rather thickly long white pilose. Antennæ black, the third joint large, suborbicular with reddish-brown pubescence. *Thorax*: shining greenish-black with long, thick, erect, pale pile. Scutellum greenish-black, somewhat brownish on the posterior half and dark brownish pollinose, the pile on its disc is pale, along its margin is a double row of very slender, long black bristles. Squamæ whitish with yellow fringe, its surface without pile. *Abdomen*: broadly oval, the first and second segments somewhat flattened, the lateral margin of the abdomen slightly curled over but not emarginate. First segment metallic black, the second shining black with a pair of melanic spots obscurely reddish, small, oval and quite widely separated by at least twice their length. Third segment with a pair of sub-basal, light brown transverse spots, each end rounded, set well back from the lateral margin, placed horizontally and separated

by almost the length of one spot. Remainder of the segment shining black. Fourth segment quite similar to the third, the spots barely less wide. The fifth is segment wholly shining black its anterior corners somewhat brownish. Pile of the abdomen long and pale upon the sides of the first and second segment, shorter but pale and erect along sides of the third and fourth segments, the pile of the third and fourth segments is broadly through their middles sparse, flat appressed and chiefly black. Pile of fifth segment long and largely black. *Legs*: all of the femora black, their extreme apices brownish. Anterior tibiae, middle tibiae, and hind tibiae except its extreme base, dark brown, all of the tarsi blackish. Pile of femora chiefly pale. *Wings*: pale brownish, the stigmal cell wholly dark brown, subapical cross vein sinuous.

Holotype. No. 23800, one female, Nikko, Japan, April 22, 1934, L. Grissett, collector.

This fly traces to *orientalis* H. B. in Shiraki's key.

#### *Syrphus convexigaster* n. sp.

Related to *orientalis* H. B. from which it differs in abdominal pattern.

Female. Length 9.15 mm, wing 8.8 mm. *Head*: upper part of occiput and vertex and front shining black, polished, black pilose. A broad, transverse, broadly interrupted fascia of golden-brown pollen lies across the quite concave lower portion of the front; its anterior margin is concave, the pollinose area is drawn out along the eye margins until it is opposite the antennae. Face extensively light brownish-yellow and yellowish pubescent on either side from eye margin to the base of the conspicuous shining black tubercle. The yellow of each side is connected beneath the antennae and at the eye margins about the middle of the face this yellow area leaves the eye margins and drops nearly vertically down the face, almost to the ventral angle of the oral margin, thus a wide, black middle stripe is left upon the face which tapers acutely to a point beneath the antennae and which diverges on either side along the oral margin and connects with the black of the cheeks. Facial pile erect, sparse and black throughout, the oral margin, the extreme posterior part of the face and the cheeks also light pubescent. *Thorax*: black in color, the details obscured by grease, its pile is erect and long, though sparse and wholly pale. Pile of pleurae long and shining yellowish. Scutellum yel-

low, the surface is greasy, with abundant very long fine bristles in several rows on the edge of and before the margin. The sparse ventral fringe is black. Squamæ dark brown, the lower lobe bare, the metasternum pubescent. *Abdomen*: broadly oval, much wider than the thorax, rather convex, the first segment dark shining brown, somewhat metallic on the sides, the remainder of the abdomen shining black, sharply marked with yellow bands as follows: a pair of broad, clear yellow bands on the basal half of the second segment, their inner ends rounded, and separated by a little more than their width and removed from the base of the segment by a little less than their width, their outer ends are diagonally, rounded-truncate and fail by half their width to reach the margin. On the third segment near the midline, narrowly removed from the base, their inner ends rounded, are a pair of spots that, after a short distance, are slightly narrowed and proceed towards the lateral margin which they narrowly fail to reach. Over most of their length except on their medial third they are removed from the base by at least their own width and they are separated in the middle by at least their narrowest width. Their outer ends are subtruncate. On the fourth segment there are a pair of similar bands almost as large and of the same general shape, they are slightly narrower, their inner ends almost touch the base and their later ends again fail to reach the margin. On the fifth segment there are a pair of small, oval, subbasal, yellow spots the medial ends more pointed, the slender, posterior margin of the fourth and fifth segments, except at the sides are yellowish. The sides of the abdomen are quite emarginate. The pile of the abdomen is pale yellow along the margins as far as the end of the third segment, over the yellow spots and to a varying extent beyond it, but the greater part of the pile of the abdomen, especially upon the third and fourth segments is short, subappressed and black, upon the fifth segment it is long and black. *Legs*: femora black except upon the apical fifth and with the hind femora upon the apical sixth. Hind femora unusually long and slender. Anterior tibiae and middle tibiae reddish, more brown upon the distal part, the latter pair diffusely yellow on the basal third. Hind tibiae brown basally and blackish-brown on the distal three-fourths. Fore and hind tarsi and apical joints of the middle tarsi dark brown; the middle basitarsi are brownish-yellow. *Wings*: tinged with pale brown; the stigmal cell very dark brown.

Holotype: No. 23801, one female, Nikko, Japan, July 15, 1931, L. Grissett collector

I have carefully compared the present fly with Shiraki's descriptions of Japanese species and I fail to identify it with any of them

*Epistrophe funeralia* n. sp.

Much smaller and unrelated by pattern, etc., to the few known species

Male Length 9.2 mm, wing 8 mm *Head*: eyes touching for a considerable distance, bare, broadly excavated in the middle on the posterior margin, the posterior occiput is grey pollinose and silvery pilose, the pile becoming black towards the vertex. Vertical triangle small, brownish-black, feebly shining, black pilose. Front broadly opaque, brownish-black, feebly shining just before either antennæ, the front is narrowly light brownish-orange along the eye margins, this area expanding opposite the antennæ into the pale broadly yellow sides of the face. The front is extensively bare above the antennæ, it is long, erect, black pilose on the upper half, shorter black pilose in the yellow margins along the eyes. Pile of face black, sparse, submarginal, confined to the anterior half of the yellow stripe. Face produced forward well beyond the base of the antennæ with a strong, convex tubercle deeply concave beneath the antennæ. Face widely shining black in the middle, roughly about one-half of the facial width being black. All of the anterior parts of the cheeks and the posterior part of the occiput below light yellow, obscurely brownish between. Antennæ widely separated, the first joint black, the second joint very dark basally, the third and the outer part of the second joint light orange, the third joint broadly infuscated above. The arista is short, thick, dark in color, the tip black. *Thorax*: dark brown, feebly shining on the anterior part, more polished posteriorly, the humeri, a spot on the sides before the suture and post calli obscurely yellowish-brown. The pleuræ are metallic brassy and anteriorly they are silvery over the metapleuræ, pteropleuræ and hypopleuræ. Scutellum large, evenly rounded, colored like the thorax except that on either side there is an oval, apically separated, large diagonal but quite obscure and diffuse yellowish-brown spot. Pile of thorax erect, chiefly light brown on the dorsum, longer and black upon the disc of the scutellum where it is sparse, the long ventral fringe of the scutellum is golden-brown. *Abdomen*: slender, the sides almost parallel, tapering a little posteriorly, chiefly deep opaque black in ground color, the narrow posterior margins of second, wider ones of third

and fourth wholly shining black, sides of abdomen not emarginate. The sides of first segment with a large, dull yellowish spot; on either side of the second segment and broadly separated in the middle is a large roughly triangular clear opaque yellow, sharply delimited spot, all of the corners of which are rounded, and which does not reach the side margins. On the third segment is a similar spot of the same size, narrowly separated, more oval, rather pointed on its medial ends and pear-shaped. Fourth segment with a pair of spots similar to that of third, almost connected across their somewhat wider medial ends. Fifth segment with a pair of smaller subbasal spots narrowly connected basally. The spots of the third, fourth and fifth segments are more brownish-orange, the pile of the abdomen is pale upon the pale spots of the second and third segments, upon the base and sides of second segment and basal half of third segment, elsewhere it is semi-appressed and black. *Legs*: basal half of anterior, all but the apex of the middle and the whole of the slender hind femora moderately shining black. Apices of the anterior four femora and narrow bases of the four front tibiae light yellowish-brown. Remainder of anterior four tibiae dark brown and the whole of the posterior tibiae black. All of the tarsi dark brown and the whole of the posterior tibiae black. All of the tarsi dark brown. *Pile of the legs*, except upon the extreme bases of the femora, black. *Wings*: strongly tinged with brown, a little more so along the anterior outer half, but everywhere diffuse; the stigmal cell the darkest of all; no stigmal cross vein present. Subapical cross vein almost straight with no sinuosity, with a slight inward bend just past its base and a slight recurrent turn just before the end; however, it joins the third longitudinal vein rectangularly.

Holotype. No 23787, one male, New Castle, Jamaica, F. B. Bryant, Feb. 16-20.

*Rhysoys quadrimaculata* n. sp.

Not closely related to any known species of *Rhysoys*, distinguished by the quadrate spots.

Male. Length 6.5 mm; wing 6 mm. *Head* large, the eyes touching for a considerable distance, the vertical triangle small, the occiput not protruding beyond the eyes on the upper third. The front is shining bluish-black, grey dusted on the upper half and with a narrow thin line of greyish-white pubescence running down the eye margin which expands anteriorly into a small, tri-

angular spot on the upper part of the face and again on the lower part of the face opposite the tubercle. The face in ground color is brilliantly shining, metallic black, with perhaps a faint bluish luster. On either side of the midline there is a prominent, ventrally connected, violet stripe, its margin golden inside and out. These stripes are rather widely separated over most of their length, their outer margins are lined by a thin stripe of whitish pubescence. Lower half of face sparsely white pubescent and diagonally striate opposite the tubercle; the middle of the face is cut by four shallow grooves, the outer ones less distinct, the profile of face above the low tubercle is perfectly straight. The first and second joints of antennæ are nearly equal in length; light brownish-yellow, third joint missing. The eyes are bare. Pile of face and front light brownish-yellow, of the vertex darker. *Thorax*: very convex, shining metallic black, seen from behind there are a pair of brownish, pollinose, median vittæ which run half-way down the posterior part of the mesonotum. There are suggestions of a fourth pair of such vittæ lying some distance from the others on the lateral part of the mesonotum. There is a low but well developed, rounded bump in the middle of the anterior lateral corners of the thorax lying diagonally from the humeri. Squamæ dark brown with dark brown fringe, halteres pale. Scutellum broadly rounded, brilliantly metallic, with two or three subterminal, transverse, faint, ripple-like depressions. Pile of thorax and scutellum pale, the ventral fringe long. *Abdomen*: long and slender, rather flattened, sides almost parallel, end of the third segment barely wider than base of the abdomen. First segment shining metallic black, second shining on the basal two-fifths with a brassy or golden-brown appearance, opaque, dark sepia-brown on almost all of the remaining segments and quite to their posterior margin. Located near the base upon the sides of the second segment, not reaching the anterior corners and covering about one-half the length of the segment there is a shallow, diffuse, brownish-yellow spot; in some specimens it extends inward for a greater distance. Third segment with a pair of large, square, light brownish-yellow spots occupying the base, the entire anterior corners and the sides for one-half the length of the segment; their medial surfaces are just a little cut-away and diminished on their posterior surfaces, remainder of this segment opaque, dark sepia. Fourth segment with a pair of similar spots, slightly smaller, barely darker, and a very little closer together;

remainder of that segment shining black. The pile upon the abdomen seems to be practically absent on the third and fourth segments, though whether this is due to denudation I cannot ascertain. The sparse lateral pile of the second segment is pale. *Legs*: almost wholly pale brownish-yellow, the narrow apices of the hind tibiae and the hind femora, a more obscure subbasal hind tibial band and the last two or three tarsal joints of all of the legs dark brown. *Wings*: very lightly tinged with brown, whole stigmal cell brown and the apical margin of the wing to just past the end of the third vein marginate with brown giving the impression of an elongate brown spot.

Holotype No 23785, one male. Cuba, Wright, and one paratype.

*Baccha cubana* n. sp.

Related distantly to the *lineata* group, distinguished by the anchor-shaped abdominal pattern.

Female. Length 7.5 mm, wing 7 mm. *Head*: hemispherical, much wider than the thorax, the eyes large, bare, their posterior margins only slightly excavated. The occiput, except at the extreme ventral part, the vertex to just before the ocelli, obscurely shining black, vertical triangle quite narrow, lateral ocellus practically touching eye margin, the ocelli set fairly well forward. Front, long widening to four times its width across ocelli with a conspicuous round black spot just above antennae, front except for this spot, and the face obscurely shining deep yellow, a little paler on the sides. Face with a low tubercle, almost straight and vertical front tubercle to antennae, but below the tubercle it retreats rapidly the short distance from the oral margin, there is a shallow concavity between epistoma and tubercle. Checks small and wholly yellow. Antennae short, third joint a little longer than wide, the first joint almost hidden, color of the antennae light orange, the third joint narrowly brownish above, arista blackish, basally thickened. *Thorax*: mesonotum broadly shining black; the shining yellow of the wide lateral margin of the thorax narrowly follows the suture inwardly on either side for a short distance. Pleurae and scutellum wholly light brownish-yellow, the latter with a pair of black, short, apical bristles and just a few short black hairs on the disc. I can discern one or two tiny black hairs that may constitute a ventral fringe. Fringe may be absent. Squamae light yellow halteres yellowish with a brownish knob.

*Abdomen*: elongate, slender, but considerably flattened, the sides posteriorly curved over narrowly along their edges. First segment short, yellow, broadly brownish across the middle, second segment barely longer than the third; third and fourth equal; fifth segment square, the second segment is almost twice as long as wide, the fourth segment just about a half again as long as wide. Second segment brown with a pair of large, oblong, brownish-orange spots well separated from the middle, anterior and posterior ends rounded, reaching the margin and on one side reaching the posterior corner. Third segment brownish-orange except as follows: a prominent median stripe the full length expanded suddenly near the apex into a marginal fascia, this fascia narrowly connects towards the side with a posterior-lateral, acute triangle of brown, produced as far forward as a distance equal two-fifths the length of the segment, the outer margin of this acute triangle is oblique. The fourth segment has a very similar pattern except that posteriorly the middle stripe reaches the apex of the segment, its lateral expansion is more or less obsolescent and the postero-lateral acute brown triangles are well developed, no wider than these of the third segment but reach forward just past the middle of the segment. Fifth segment quite similar to the fourth in every respect except that it is smaller and that the postero-lateral triangles are merely elongated vittæ reaching the same proportion of the segment. *Legs*: the legs seem to be wholly light yellow, basal half of the hind tibiæ barely darker because the pile appears to be darker. The pile is chiefly pale golden but on the hind femora and basal half of its tibiæ it is largely but not entirely brown. *Wings*: pale brownish, diffusely darker brown throughout the subcostal marginal cell and the apex of the submarginal cell, subapical cross vein rather sinuous, joining the third vein at right angles.

Holotype: No. 23784, one female. Soledad, Cuba, Feb. 27th, 1926, George Salt.

*Baccha ochreolinea* n. sp.

Related to *cultrata* Austen, it is characterized by the broad abdomen and interrupted yellow fascia of the third abdominal segment, etc.

Female. Length about 8 mm.; wing 7.5 mm. *Head*: hemispherical, deeply excavated in the middle, vertex narrow, dark, obscurely shining brown, continued forward as a wedge of slightly



decreasing width to the middle of the face. There is a tiny black spot above the antennæ, quadrate, connected to the slightly larger, deep lunule of brown above it. Ground color of front, face and cheeks pale yellow, the former slightly brown in the middle, the pile of the occiput on the upper fifth of vertex, front and upper part of face erect and black, a very little pale pile on either side of the tubercle. Occiput except immediately behind the ocelli pale yellowish pollinose. Tubercle small, extending barely beyond the base of the antennæ, profile almost straight above the tubercle, retreating sharply below it, the cheeks small. Antennæ light orange, the third joint broadly dark on the dorsal half and the apex and scarcely longer than wide, pile of the basal joints black; arista black. *Thorax*: dark golden-sepia with a pair of obscure, yellowish-brown pollinose vittæ extending somewhat past the mesonotal suture and between it a narrow line of the same color. Lateral margins of the thorax broadly yellow, pleuræ, except propleuræ, lower sternopleuræ, lower pteropleuræ, hypo and metapleuræ pale yellow, otherwise dark brown. Scutellum wholly light brownish-yellow with several black bristles on the margin and five or six black hairs on its disc, I cannot discern any ventral pile. *Abdomen*: broadly oval, quite flattened, the first segment yellow on the sides with bristly black pile broadly brown across the middle. Second segment almost a third again as wide posteriorly as anteriorly; shining dark brown in color and somewhat lighter along the sides with a conspicuous, transverse fascia across the middle of uniform width, slightly convex, not quite reaching the side margin. Third segment barely wider posteriorly, of similar ground color, it has a slender, basal, yellow fascia not reaching the side margins and a quite broad fascia across the middle; it is broadly interrupted in the middle anteriorly narrowly from its posterior medial corners and on each side in the middle slightly concave. This fascia does not quite reach the lateral margin. Fourth segment with blackish markings on a light yellowish-brown background as follows, the entire narrow lateral margins; on either side from the posterior margin a large triangle is directed towards the base of the segment and reaches two-thirds of its length, its medial surface is more or less straight and its outer surface approximately straight but diagonal. There is a broad, median vitta rounded off anteriorly, a little wider anteriorly and just reaching the base of the segment. The median vitta and the lateral triangles are narrowly connected along the

posterior margin. The anterior corners of the segment are dark brown and connected with the brown lateral margins. Fifth segment marked in an exactly similar way, the lateral triangles more slender but reaching almost to the base of the segment and not connected with the somewhat more slender median stripe which latter is concave on each lateral surface, the antero-lateral corners of brown arc absent, sixth segment with three median vittæ of brown. Pile of abdomen wholly flat-appressed and black. Fourth segment about twice as wide as long, the third segment barely longer, the fifth barely shorter, the third barely shorter than the second. *Legs.* anterior and middle pair wholly pale yellow, pale pilose, the middle femora with a posterior row of long dark hair. Posterior femora light brown, apex yellow with a wide, dark brown, subapical annulus, almost the whole of its pile is black. Hind tibiæ except for the very narrow base wholly dark brown, blackish pilose. Hind tarsi wholly yellow. *Wings:* very darkly tinged with brown, rather deep, and elongate oval, the alulæ is small, the subapical cross vein rather sigmoid.

Holotype. No 23802, one female. Canal Zone, Barro Colorado, July 24, 1924, N. Banks collector.

*Salpingogaster panamana* n. sp.

Related to *cothurnatus* Bigot, it differs in the red and yellow pleuræ and yellowish brown tarsi.

Male. Length 12.5 mm; wing 9 mm. *Head:* vertical triangle shining blackish, the front narrowly yellow upon the sides, broadly brownish-black in the middle, not especially protuberant. Face pale yellow and shining with short, pale yellow shining hair, rather sparse. There is no black or dark facial stripe. Antennæ light brown throughout, without any suggestion of yellow or orange. Occiput black, sparsely pale pilose. *Thorax:* broadly dark brown over the mesonotum which is somewhat greasy and in consequence the arrangement of the pollen or possible vittæ is obscured. Nevertheless the thorax appears to have been broadly greyish pubescence throughout the middle, it was probably vittate. The humeri, a stripe along the sides as far as the suture only, the post calli and the whole of the scutellum except for a brown transverse band, pale yellow. *Pleuræ* reddish brown with a broad stripe on the posterior half of the mesopleuræ and propleuræ, anterior portion of the pteropleuræ and the greater part of the sternopleuræ pale yellow. There is a second small

wedge-shaped yellow spot or stripe upon the metapleuræ. *Abdomen* chiefly yellowish, the first segment wholly yellow, second segment light brownish-yellow throughout with a slender but inconspicuous scarcely darker brownish line down the middle. Third segment yellow laterally on the basal two-fifths, in the middle and upon the entire remainder of the segment light reddish-brown. Whole of the fourth segment and the hypopygium reddish-brown. The hypopygium seen from above is bulbous at the base and drawn out into an abrupt point, therefore the hypopygium proper viewed from above looks somewhat like an acutely pointed equilateral triangle. The pile of the abdomen is pale yellowish upon the first and second segments, on the remainder of the segments it is brown but not black. The abdomen is rather slender in shape. *Legs* anterior legs almost wholly light yellow, last four joints of tarsi pale brown, the middle pair exactly the same, hind femora brownish on the basal fifth and obscurely brownish before the apex. Hind tarsi brown, appearing darker because of the black pile, the apical joint yellow. Hind femora ventrally with sparse black spinules throughout its whole length which near the apex are arranged in a single row on each side. *Wings* upon the costal, and upon the subcostal and marginal cells, clear yellow as far as the end of the costal cell. The outer or stigmal portion of the subcostal cell and the outer part of the marginal cell sharply dark brown, the color extended narrowly along the apical margin of the submarginal cell. The brown of the subcostal cell is definitely darker than that of the marginal cell. Also the fifth longitudinal vein throughout its posterior section and base is margined with brown. Subapical cross vein strongly sigmoid, loop of third vein deep, rising vertically.

Holotype No 23803, one male. Bella Vista, Panama, August 8, 1924, N. Banks collector.

This species is somewhat similar to *cothurnatus* Bigot from which it appears to differ in a number of particulars. It is considerably smaller and the tarsi are pale brown, tending rather to be yellowish instead of black as described by Bigot. Apparently the pleuræ of *cothurnatus* are black whereas here they are reddish, with a single large yellow and a single small yellow stripe. The abdomen in this species is more extensively yellowish, in *cothurnatus* reddish with the posterior borders brown. I have a specimen from Panama quite different from the present specimen.

and which more closely agrees in size and black pleuræ with the description of *colhurnatus* and is so close to the present species in type of wing pattern and general coloration and triangularly pointed hypopygium that the general similarity between the two is remarkable. Nevertheless they are abundantly different in many respects. It is worth noting that the description of *colhurnatus* by Sack in the revision of the genus disagrees from Bigot's description in the particulars of the color of the tarsi. Sack describes the hind tarsi as wholly yellow and the anterior tarsi yellowish with the three last tarsal joints black.

***Microdon aureus* n. sp.**

Related distantly to *bcebei* Curran, but characterized by its golden pile.

Female. Length 19.5 mm which includes the 4 mm antennæ, wing 11.5 mm. *Head*: vertex and upper occiput dark, shining, metallic green, becoming more or less opaque black on a transverse band in front of the scutellum from eye to eye. Front very shallowly concave, the antennæ situated high upon the head with very short front. Pile along the upper part of the occiput exclusive of post vertex, very short, appressed, brassy yellow. Pile behind vertex longer, upright, black, immediately about the ocelli it is short, appressed, black. Upon the front there is a black pilose area upon an opaque black band; just in front of the opaque black band is a transverse band of pale brassy pile, its anterior border directed forward, its posterior border directed backward and culminating in each eye margin in a fan-like tuft of flat-lying, similarly colored pile that is directed towards the mid-line. Pile of face, except for a black area on the eye margins of the lowest part of the front everywhere pale golden, short, flat-lying and wiry. A tuft of black hairs is directed downward over the middle of the epistoma. There is a vertical band of pale pile on either side of the mid-line of the face, a transverse band from the eye margin to the anterior margin of the epistoma, there is also a rough, rounded area below the antennæ on each side, which is covered by a downward and somewhat obliquely directed area of pile running from the base of antennæ towards the eye margin. Face everywhere shining black except for a mere suggestion of a light colored spot on each side near the middle and near the eye margins. Antennæ elongate, quite slender, the third joint barely longer than the first two, the second joint not quite

half as long as the first Basal half of first joint dark reddish-brown, remainder of antennæ black Labellum of face with a pollinia from an orchid attached to it *Thorax*: dull black with purplish and greenish reflections, a very narrow stripe of pale pile along the margin some distance from the edge of the lateral sutures that forms anteriorly a collar of pile back of the head A broad equilateral prescutellar triangle and the whole of the scutellum is covered with flat, long, backward-directed, thick, brilliant golden pile The remainder of the mesonotum is covered with appressed, very dense and extremely short black pile, metanotum greenish *Abdomen*: elongate, the second segment flattened, barely wider than long, with on its anterior margin a pair of narrowly separated, almost confluent, nearly rectangular, translucent spots; these spots are pale yellowish, unusually hyaline and each spot narrowly reaching the lateral margin in the middle of each side of the segment. Remainder of second segment and of the remaining segments wholly dull black. The abdomen, beyond the second segment, forms a stout, deep, cylindrical, bluntly-pointed, club-shaped body that is everywhere microscopically black and flat-setate. The middle of the first segment has a transverse band of golden appressed pile *Legs*: everywhere, except narrowly at the base of the hind femora, black in color The femora have slight greenish reflections the base of hind femur reddish brown Pile of legs extremely short and pale, dense and appressed *Wings*: with the usual spur vein, which is however, quite obliquely produced forward Wing rather pointed, the posterior angles of the first and second posterior cells very much rounded The entire anterior border of the wing dark brown including the costal, subcostal, marginal, submarginal cells, narrowly the posterior side of the third longitudinal vein, the whole of the first basal cell and both margins of the small cross vein and its connection to the fifth longitudinal vein.

Holotype: No 23807, one female: Jatun Yacu, Rio Naxo, Watershed, 700 meter, Oriente, Ecuador (Wm C MacIntyre)

*Mixogaster orpheus* n. sp.

Closely related to *anthermus* Walker but with minor differences in the wing venation.

Female. 12 mm. excluding antennæ, wings 12 mm. *Head*: vertex, except immediately around the ocelli, occiput, except for a diagonal stripe from the corner of the eyes, and front except for

a transverse band across in front of the antennæ including the short antennal prominence and a conspicuous round spot just beneath the antennæ, everywhere light brownish yellow; the exceptions noted are brown. The following areas are also brown: an oval spot or stripe diagonal from the corner of the eyes to the back of the occiput in which there is an impressed line, the area immediately around the ocelli, a conspicuous round spot beneath the antennæ all brown. There is a large, transverse spot above the antennæ, including the short but black antennal prominence which is reddish brown and is widely separated from the eye margins. Antennæ light brown, second joint half as long as first, third joint missing, antennal pile dark brown, extreme base of first joint with a black annulus. Face rather conspicuously concave just above the middle with very sparse pale pile. Eyes bare. *Thorax*: chiefly light brownish-yellow, with a short pair of submedian, slender, brown stripes that are almost fused with a much wider pair of stripes that lie on either side of the thorax and run throughout its length and slightly converge posteriorly and whose anterior lateral ends fill out the entire corners of the thorax behind the humeri, leaving, however, a large yellow spot before the suture. Pleuræ wholly pale, shining yellow, almost bare with a single diagonal reddish stripe from base of wing down to hind coxæ and a brown stripe behind the metapleuræ. Scutellum broadly brown across the disc, the base and the posterior margin yellow, somewhat triangular in shape with rounded apex. Metanotum yellow; humeri yellow, squamæ yellow with a brown margin and fringe, halteres brownish yellow. *Abdomen*: elongate, quite petiolate, the first and second segments are subcylindrical, fused, narrowest in the middle and not quite as long as the remaining three segments. There is a reddish stripe running from the base of the second segment diagonally down the long second segment to meet the opposite stripe in the middle a short way from the end of the segment, elsewhere the first two segments are shining yellow. The remainder of abdomen is light brown, the posterior third of the third segment uniformly light yellow; pile of abdomen everywhere pale. *Legs*: wholly light yellow, the apical two-thirds of the hind femora a little darker; pile of legs wholly yellow. *Wings*: large and long, longer than abdomen, faintly brownish-yellow along the anterior half with stigmal cross vein, very short anterior cross vein and with a practically straight subapical cross vein that joins the third vein approximately at a

right angle, posterior corners of the first and second posterior cells with well developed spurs

Holotype No 23794, one female Bartica, British Guiana, August 19, 1901, collection C W Johnson

This fly, which is a true *Mixogaster* because of the fact that it lacks any spur or vein from the third longitudinal vein into the first posterior cell as well as by its petiolate form, is characterized by its light brownish yellow color and large wings. It was compared at the British Museum by myself with the type of *anthermus* Walk and found to be very close to that species differing, however, in particulars of the wing venation. It is also close to *anthermus* from the Amazon region in other respects, differing in the less developed occiput, the less retreating face and in the presence of the lateral yellow spot anterior to the suture of the thorax, in the absence of a much reduced brown square upon the metanotum and in the isolated brown spot around the ocellus. There are probably other differences but the general pattern coloration in the dried specimens leaves the markings obscure

#### *Planes proxima* n. sp.

Related to *vagens* Wied, the anterior tibiae are extensively dark brown, the lower part of the face is reddish brown and the abdominal pattern is different

Female. Length 9.15 mm; wing 6.8 mm. *Head.* eyes bare, vertex in front shining bluish-black, the latter with a broad silvery pubescent band from eye to eye which is indented above and below in the midline, almost the whole of the face is covered with pale greyish-white pubescence, worn off a little on either side below the sharp facial carina, ground color of the face metallic black, except that it is obscurely reddish on either side above the oral margin, the face is retreating and in profile very shallowly concave on the lower part. Antennae elongate, the first and second joints dark brown, the third reddish basally and on the ventral third but otherwise dark greyish-brown, arista long, slender, reddish. *Thorax.* obscurely shining black, chiefly short pale pilose, with some black pile along the middle behind the suture and more extensive black on the sides behind the suture but beginning to vanish as it reaches the posterior calli. The pile, then before the scutellum is broadly pale, somewhat appressed and more or less directed forward and towards the sides. Seen from behind there are a pair of widely separated, broad, median

vittæ of pale shining yellow pile which is directed more or less forward. Pile and pubescence of the mesopleuræ whitish, scutellum with a strong brassy cast, faintly impressed rim, its pile about half and half black and pale. *Abdomen*: elongate, narrowest at the end of the third segment where it is but little less wide than the base of the third segment. Ground color anteriorly very dark brown, almost blackish, becoming more brassy on the fourth segment. First segment shining dark reddish-brown with a strong brassy cast that is quite absent upon the next two segments. On either side of the second segment, widely separated, is a pair of large yellow spots opaque, rectangular, with corners rounded, the anterior lateral corner slightly attenuated, the posterior corners vaguely attenuated, widely separated from the lateral margins. On the third segment there is a pair of similar, smaller, more diffuse and more obscure spots. Pile of fourth segment wholly semiappressed, pale yellow and quite abundant. There are not over three or four black hairs in the middle of this segment. Pile of fifth segment erect and wholly pale. *Legs*: all of the femora very dark brown almost black with narrow reddish apices, the hind pair with the usual rather extensive thickness; its pile is pale but its ventral spines black, quite long and sharp and beginning quite in the middle of the ventral surface of the femora. Anterior tibiæ blackish-brown upon the apical half dorsally, and ventrally upon the apical two-thirds brown quite to the apex. Middle tibiæ almost wholly yellowish, pale whitish on the basal half, faintly brownish apically, the spines black. Posterior tibiæ quite arcuate, the basal third pale yellow, the remainder dark brown, the apical spur triangular but quite sharp and rather long, the pile is wholly pale except along the whole of the ventral margin there is a narrow dense band of erect black pile. Basal three joints of anterior and middle tarsi wholly pale yellow, their apical and hind tarsi light brown. *Wings*: lightly tinged with brown, stigmal cell wholly dark brown; there is no spur from the posterior corners of the first and second posterior cell.

Holotype: No 23791, one female, labelled '*proxima*' beneath which is the label — "*variety of ejuncida*" Loew coll. There is no locality. It is presumably from the West Indies.



*Crepidomyia darlingtoni* n. sp

Related to *tricrepis* Shannon but very distinct in the smoky wing apex

Male Length 14 mm ; wing 10.8 mm *Head*: rather short and therefore wide and flat, the eyes are large, conspicuous, bare, the anterior facets slightly enlarged above, touching only a short distance. Vertical triangle obscurely shining black and long, erect black pilose. Upper third of occiput black and black pilose. The whole of the flat front totally obscured by thick, microscopic, brilliant, golden pubescence. Face strongly carinate with a lateral ridge or keel reaching from eye margins of epistoma slightly concave anteriorly along the lateral keels and this broad shallow concave area is covered by pale brassy pubescence forming a broad stripe from the lateral facial strips to the oral margin; remainder of face shining black, facial strips pale pubescent, cheeks shining black. Antennæ black, the third joint with brownish pubescence, about half again as long as the third joint, gradually thickened towards the base, blackish on the basal sixth, remainder white. *Thorax*: dull black with a brownish tinge due to four very obscure barely discernible vittæ, the inner pair are shorter, more closely separated, but diverging posteriorly, the outer pair reaching to the scutellum. On the extreme anterior edge of the mesonotum lying inside the humerus there is an almost equilateral triangle of pale shining yellow pubescence. Along the dorsal suture, stopping someways from the midline there is a long, slender, marginal stripe of yellowish-brown pubescence, upon its medial ends and anterior side it curves sharply backwards for a little distance. Pile of thorax wholly suberect, black. Scutellum shining black with faintly impressed rim, its discal pile black, its ventral pile thick, long and pale. *Abdomen*: moderately long but compact, not so wide as thorax, widest at the basal third segment, but scarcely less wide either at base or end of fourth segment; wholly shining black, the first two segments somewhat flattened, the pile everywhere flat-appressed and black except as follows: sides of first segment and broadly over the anterior corners of the second nearly to the end of the segment of erect pale pile; a small, marginal, lateral, subbasal patch of white pile on the third segment and a medio-apical patch on the last segment. *Legs* chiefly shining black, the anterior tibiæ distally, greater distal part of the middle tibiæ dark brownish-black. Anterior basal tarsi dark

brown, two basal, mid-tarsal joints and the hind basal tarsal joints light brown. Hind tibiae with a short, inconspicuous, ventral apical spur, hind femora considerably thickened in the middle, more slender on the posterior half than on the basal half and all of the thickening confined to the dorsal side of the femora. Hind trochanters with a long spur. Metasternum pubescent; without spur. *Wings*: strongly tinged with brown on the anterior-apical half, becoming diffuse posteriorly, the color more sharply delimited about the stigma, the point of fusion of the subcosta and at the separation of the first and second longitudinal vein.

Holotype. No 23789, one male. Mounts north of Imias, Eastern Oriente, Extreme eastern province of Cuba, July 25-28, 1936, 3-4,000 ft. Darlington collector.

I take pleasure in naming this handsome species for Dr. Darlington, who has brought so much interesting material out of the West Indies.

#### *Temnostoma japonicum* n. sp.

Related to *bombylans* Fabr., but differing in the dark pattern of the wing, the basally black femora, etc.

Male. Length 14 mm; wing 11 mm. *Head*: eyes bare, almost touching in the middle. The vertical triangle is obscurely shining black, but only as far as the corner of the eye, the entire occiput is dull, brownish-golden pollinose, narrowly divided in the midline and extending just a little further posteriorward along the eye margin. The lower part of the front golden pubescent except for a prominent, acute, shining black triangle above the antennae, its apex continued as a narrow line to the narrow black area between the eyes. There is a smaller, impressed black triangle within the larger one. Face shallowly concave below the antennae, broadly shining black, finely striate in the midline, the midfacial stripe expanding to a large triangular area below the antennae, elsewhere the face is broadly golden-yellow pubescent, and with only very short, sparse, pale pile upon the lower part of the face in front of the cheeks. Antennae light orange, the third joint oval after an oblique fashion, its margin rounded. Arista light orange, the cheeks shining black. Front without pile, that of the vertex shining yellowish. *Thorax*: dull black, scutellum of the same color, the mesonotum with a pair of obscure greyish vittae set close together that run half of the distance from the suture to the scutellum. There is a conspicuous, laterally widened,

medially tapered, golden, pollinose stripe lying in front of the transverse suture, broadly interrupted in the middle, but continued over most of the posterior part of the mesopleuræ. There is no trace of pale pollen anterior to the posterior calli, but there is a quite obscure, reddish pollinose spot lying upon the mesonotum at the base of the scutellum. Pile of the anterior half of the thorax short and shining reddish, of the posterior half short reddish with considerable black hair around the middle. Pile of scutellum wholly reddish, of mesopleuræ whitish. *Abdomen:* elongate, with almost parallel sides, the third segment barely wider than at the end of the second segment and at the end of this segment about as wide as the thorax. Ground color of abdomen black, dull in color, obscurely shining upon the fourth and last half of the third segment and posterior corners of second. Second segment with slightly oblique, much elongated, narrowly connected yellow spots; their lateral ends are rounded and they lie on the basal third of the second segment. Viewed from behind, these spots appear to be completely interrupted. On the third segment there are a pair of similar golden-yellow pollinose spots which are more slender, reach no closer to the lateral margin, but are slightly more pointed laterally and which are narrowly connected in the middle of the medial ends. On the fourth segment there is a transverse, somewhat broader, narrowly sub-basal, similar, golden pollinose band shallowly indented in the middle near its lateral ends, turning slightly downward in oblique fashion; its lateral, somewhat pointed ends do not reach the side margins. The spots of the third segment are more transverse than either of the other two. The pile of the whole posterior two-fifths of the third segment except narrowly on the sides is appressed and black, the pile of the third segment is wholly appressed with considerable black pile confined to a central area on the posterior half, elsewhere it is shining reddish. The whole of the pile of the fourth segment is flat appressed and shining reddish. Pollen of the second and third fascia more brownish, that of the second segment pale yellow. *Legs:* all of femora except their apical third or less black with sparse greyish pollen and wholly pale pile; apices of these light reddish brown. Anterior tibiæ reddish-brown, dark brown upon the antero-medial surface of the apical half, middle tibiæ wholly light reddish-brown; hind tibiæ similar in color, a little darker upon the medial posterior margin on the apical half. Anterior tarsi wholly black, the last

joint reddish brown pollinose, middle and hind tarsi wholly pale reddish-brown; pile of hind tibiae and tarsi and a middle tibiae and tarsi wholly pale, of the anterior tibiae and tarsi wholly black except upon the ventral medial margin of the former and ventrally upon the basi tarsi. *Wings*: broadly reddish-brown upon the anterior half, as far as the posterior margin of the first basal and upon the first posterior cell as far as the posterior margin of the first basal and upon the first posterior cell as far as the end of the vena spuria. Anterior margin of first posterior cell broadly brownish, almost to the apex of the cell. Apical margin of submarginal cell paler. The costal and second basal cell light brownish-yellow. Vena spuria especially dark brown.

Holotype No 23798, one male. Nikko, Japan, L. Grissett collector, July 19, 1931.

This specimen I had tentatively determined as *T. bombylans* Fabr. I now believe that it presents specific differences from that species. It is characterized by the extensively basally black hind femora and the definitely indented and almost interrupted cross band of the abdomen and the strongly reddish pile of the thorax and abdomen.

#### *Temnostoma fumosum* n. sp.

Distinct from *bombylans* Fabr., in the concentration of the dark wing color near the middle of the wing.

Female. Length 14 mm, wing 12 mm. *Head*: occiput tumid, together with the vertex bare upon the upper part and shining black, front shining black, especially polished upon the lower half with a short linear stripe of brownish-white pubescence along the eye margin that begins a short distance below the ocelli. There is a trace of a similar spot in the middle of the front, it may be that the front was originally broadly light brownish pubescent. Face shining black, strongly concave on the lower portion, the bottom of the concavity lying at the tip of the antennae, in this specimen it so happens by accident that the antennae are folded down and just fit into the concavity. Face covered with a very sparse scattered, whitish pubescence and still more sparse, pale pile. Cheeks shining black. Antennae large, the first two joints shining, brownish-black, the third is much wider than long with evenly rounded margins, reddish-brown, silvery pubescent. Arista very long and slender, reddish in color. *Thorax*: moderately shining black, rather convex with appressed pile which is

chiefly black but is broadly reddish down the midline and again just before the scutellum. There is a narrow obscure line of pale pubescence along the outer portions of the mesonotal suture. Humeri convex, shining black, pale pilose. Scutellum obscurely shining black with some long pale pile and shorter, black, tuberculate, setaceous pile. *Abdomen*: quite convex, elongate, somewhat oval, widest in the middle of the third segment, the base of the abdomen but little wider than the apex, the abdomen somewhat wider than the thorax at its widest point. Color of abdomen chiefly black, moderately shining. On the second segment there is a pair of linear, very obscure, reddish, almost obsolescent spots, they are widely separated in the middle and do not reach the sides; they are slightly oblique and placed a little before the middle of the segment. If the abdomen is viewed from the front the spots become more evident because they are clothed with thick, pale yellow pubescence. Pile of the posterior three-fourths of the segment appressed and black. On the base and sides of the segment the pile is quite long, erect and whitish. The third segment has a pair of similar, slightly oblique, larger and more evident linear bands which almost reach the side margins and which occupy a natural depression in the abdomen, they are narrowly separated in the mid-line, are reddish in color and are outlined from in front chiefly by thin golden pile and very little pubescence. The fourth segment has a conspicuous, complete, sub-basal band running almost to the lateral margin and diverging a little from the basal margin towards the sides. This band is light reddish-brown pollinose but there is some evidence that it may have been golden pollinose originally. It is sparse, golden pilose, elsewhere the third, fourth and fifth segments are shining black and semi-appressed black setate. *Legs*: femora almost wholly black, only the very narrow apices brown. Hind femora quite slender, fore tibiae wholly black, its very narrow base excluded, middle and hind tibiae chiefly black, narrowly brownish apically. Anterior tarsi wholly black. Middle and hind tarsi light reddish-brown on the basal three joints; others dark brown. *Wings*: with a strong brown spot on the anterior border just past the middle, occupying the region from the costa to the vena spuria and all of the basal part of the marginal cell and the area below this to the vena spuria, extending moreover along the posterior margin of the fourth longitudinal vein for a short distance on the apical side of the small cross vein, extending off on both sides of the

third longitudinal vein but growing fainter apically, extending broadly along both sides of the second longitudinal vein all the way to the costa and filling the stigmal cell.

Holotype· No 23799, one female. Nikko, Japan, July 10, 1931.  
L. Grissett, collector.

SOME AFRICAN BEES OF THE GENUS *NOMIA*

BY T. D. A. COCKERELL

The bees recorded in this paper belong to the British Museum, but will be retained by me until after the war.

*Nomia semlikiana* Cockerell

Uganda, Entebbe, April 12, 1914 ♀ (C. C. Gowdey)

*Nomia matha* (Cameron)

Natal, Van Reenen, Drakensberg, Dec., Jan. (R. E. Turner), Cape Province, Worcester, Jan. (Turner), Milverton, Cape Town, Jan. 1926 (Turner)

*Nomia heterodoxa*, sp. n.

♂ Length about 11.5 mm, anterior wing 10.8, black, with the scape red at base, flagellum obscurely reddened beneath, and the legs bright ferruginous, face very narrow, with pale cinereous hair, the lower part of clypeus swollen and exposed; vertex shining, pronotum with a narrow pale fringe, mesonotum and scutellum dull, not hairy, the mesonotum with linear notauli and a slender median line shining, scutellum elevated, with a pair of large bosses, shining at end, base of metathorax dull, with a shining median groove, tegulae rather large (but not of the large type) with a light brown boss and subhyaline margins, wings very long, with a large dark brown stigma and brown nervures, the basal nervure, curved at lower end, meeting nervulus, the second submarginal cell small and very narrow, the wings are hyaline at base, but the apex is occupied by a very large black cloud, which includes the apical half of the marginal cell, legs slender and simple, the hind basitarsi very long, anterior basitarsi with very long hairs; abdomen with the basal tergite highly polished, the others mainly dull, without hairbands, the apical margins of second and third tergites reddened, fifth sternite with a black elevation on basal middle. Uganda, Mabra Forest, Chagwe, 3500-3800 ft., July 1911 (S. A. Neave). Related to

*N. ruwenzorica biconica* Ckll., but easily distinguished by the tegulæ and the peculiar pattern of the wings

*Nomia heterura* Cockerell

Gold Coast, Yapi, Dec 1916 (J J Simpson) A typical female, with red tegulæ. The following females have dark tegulæ, but seem to belong to the same species. Gold Coast, Yapi, Dec 1916 (J J Simpson), Yapi, Sept 1916 (Simpson) S Nigeria, Ibadan, July 27, 1920 N Rhodesia, Buyamungoma Boma, Jan 14, 1911 (Silverlock)

*Nomia platycephala* Cockerell

Pondoland, Port St John, March, 1924, ♂ (Turner) On close comparisons, I conclude that this is probably a form of *N matha* (Cameron), although the wings are paler than is normal for *N matha*. The legs are black, and it is certainly not the same species as *N breviceps* Ckll, described from the male in 1939 as a sub-species of *N matha*. The sexes of *N platycephala* are tabulated in Annals Durban Museum, Aug 1920. In Ann Mag Nat Hist, March 1935 *N matha* and the apparent synonym *N rugicollis* Friese are discussed, and it is left uncertain whether we should recognize one or more races or closely allied species

*Nomia laticincta* Friese

Lonely Mine, S Rhodesia, six females, Dec 1913, Jan, March and April 1914 (H Swale). The tegulæ vary in color, being in some specimens dark. As I suggested in 1939, this is probably to be regarded as a race of *N. murinella* Ckll

*Nomia tricoloripes* Cockerell

British E. Africa. Masai Reserve, April 26, 1913 (T. J. Anderson) ♀ The female, not before known, resembles the male in most respects, but the legs are black, except the ends of the tarsi, and the front and middle knees. The hair on scutellum and post-scutellum is distinctly reddish, contrasting with the pale grey of the mesonotum. This suggests *N murinella*, from which it is easily known by the dense fulvous abdominal bands, very broad on tergites 3 to 5. The tegulæ are translucent pale reddish, and the short flagellum is dusky red beneath. The tegulæ distinguish it from *N. tricineta* Friese, the tegulæ of which have a black boss and a hyaline margin.



*Nomia victoriella* Cockerell

Uganda, between Seziwe River and Kampala, 3500-3750 ft., Aug 27-31, 1911 (S. A. Neave). A male differs from the type by having a large red spot at each side of first tergite, as sometimes occurs in *N. stanleyi* Ckll. A typical male *N. victoriella* is labelled Uganda Prot., Entebbe (Forest), 3800 ft., July 5-11, 1911 (S. A. Neave).

*Nomia serratula* Smith

Pondoland, Port St. John, male (R. E. Turner).

*Nomia polytricha* sp. n.

♂ Length 8 mm; anterior wing 6.8; black, rather slender; mandibles black; antennæ black, with the long flagellum very faintly brownish beneath, head and thorax with abundant grayish-white hair, not dense enough on mesonotum to hide the surface, face (but not front) densely covered with coarse grayish-white hair, vertex dull, mesonotum dull, a little shining on disc; scutellum shining, small, prominent, unarmed; upper sides of metathorax polished; tegulæ enlarged, with a very large black boss, and a broad posterior lobe, which is pallid but inconspicuous, wings long, dusky hyaline, the apical area brownish, stigma large, reddish brown, nervures pallid, lower section of basal nervure nearly straight, except that it is abruptly bent at lower end, meeting nervulus; second submarginal cell large and square, receiving recurrent nervure near the middle, legs slender and simple, with much pale hair, small joints of tarsi more or less reddened; abdomen with first and second tergites shining, the punctures very small; tergites with dull white hair-bands, on first confined to sides, on second broadly interrupted, no red hair at apex; fourth sternite with a large patch of pale reddish hair.

British East Africa; Kabeta, 6000 ft., April 11, 1918 (T. J. Anderson).

In my table this falls near *N. kampalana* Ckll., but the abdomen is narrower at base being subclaviform, and the dark tarsi and abdominal characters are distinctive. In Strand's table it runs out near *N. parca* Kohl. *N. kampalana* is also considerably smaller.

*Nomia elgonica* sp. n.

♂. Length nearly 10 mm., anterior wing nearly 9, black, rather slender, antennæ black, hind tibiæ chestnut red, front and middle tibiæ reddened at end, tarsi pallid reddish; head circular seen from in front; face covered with slightly fulvescent hair, in one specimen partly denuded on clypeus; front and vertex dull; thorax with dull white hair, scanty above, mesonotum dull; scutellum hairy, dull, unarmed; area of metathorax a rather wide channel, broadly angulate in middle, with cross plicæ; sides of metathorax posteriorly dull, tegulæ rather elongated, posteriorly with a dark boss, but anteriorly broadly thin and hyaline, wings long, conspicuously reddened, but without a dark apex; stigma very pale red, nervures darker, basal nervure with lower section straight except at lower end, where it is abruptly bent and meets nervulus, second submarginal cell large, varying in width, receiving recurrent nervure beyond the middle; hind femora moderately stout, with a strong tooth beneath, hind tibiæ very broad apically; abdomen dull, without a red spot; fourth and fifth sternites shining, not tomentose

Uganda, Mt. Kojanjero, S. W. of Elgon, 6400 ft., Aug 7-9, 1911 (S. A. Neave) Two specimens

In a series of similar species it is known by the red hind tibiæ, ordinary head, and entirely dull mesonotum, without punctures evident under a lens. It is to be compared with *N. langi* Ckll., which comes from Stanleyville in the Belgian Congo, and agrees in the toothed hind femora and red hind tibiæ, the wing is 7.4 mm long, and the mesonotum is different. There is evident affinity with the South African *N. phenacopoda* Ckll., which is smaller, and has a broad short head, and a red spot at end of abdomen. Compared with *N. dominarum* Ckll., the stigma is very much paler, and the marginal cell is shorter. *N. snelli* Ckll., from Zanzibar, is also related, but the hair on thorax above is quite different.

## WASPS FEEDING ON COMB-HONEY

BY PHIL RAU

Kirkwood, Missouri

When a plate of honey is placed out-of-doors to attract honey-bees, it is interesting to see how quickly wasps are also attracted to it. Honey in a tin plate is certainly different in its setting and in its quality from the weak nectar in the flowers which wasps are accustomed to patronizing.

But if wasps and honey-bees are attracted to honey, it is strange indeed that solitary bees are not likewise attracted to it. In the clay bank in my garden, not far from the honey dish, many *Anthophora abrupta*, *Osmia cordata*, *O. lignaria* were nesting but none of these ever came to the honey. In the wooden frame above the clay bank many *Xylocopa virginica* were also nesting and even though I have often fed them honey from a glass rod while they were trying to extract nectar from the flowers, I have never seen *Xylocopa* go to the honey-plate.

Many bumble-bees, *Bombus americanorum*, visit the flowers nearby, but none of them are attracted to the honey in the dish. Do wasps and honey-bees learn more quickly than wild bees that honey is a richer food than nectar, and that honey in a dish is more accessible than nectar in the flowers?

The following wasps have often been seen feeding from a dish of honey:

*Monobia quadridentata* L., both sexes

*Eumenes fraternus* Say

*Sceliphron cæmentarium* Drury

*Polistes pullipes* Lepel

*Polistes variatus* Cress

*Vespa maculifrons* Buyss, workers

*Arachnophroctonus ferrugineus* Say

Honey-bees, as already stated, were easily attracted to a dish of honey in the grass, but what is surprising is that the dipterous, heavy-bodied mimic of the honey-bee, *Eristalis tenax* L. [C. T. Greene] was also often attracted to it and ate heavily of the honey.

THREE SPECIES OF COLEOSOMA FROM FLORIDA  
(ARANEÆ; THERIDIIDÆ)<sup>1</sup>

BY ELIZABETH B. BRYANT

Among material recently sent the Museum of Comparative Zoology by Mr. George Nelson from Sebastian, Florida, were specimens of *Coleosoma flavipes* O.P.-Cambridge, described from males, and known only from the type localities in Mexico and Guatemala. Impressed by this discovery, I wrote to Dr. William M. Barrows, who has collected in Florida, and was gratified to receive in response *Coleosoma* collected by him at various times.

Among this material, I have identified not only *Coleosoma floridanum* Banks, the only species of the genus previously known from the state, but also both males and females of Cambridge's *C. flavipes* together with a male and females of an undescribed species, *C. normale* spec. nov. Of this material, *C. flavipes* Camb. and *C. normale* were taken in Florida in early summer. Cambridge does not mention dates in his descriptions. *C. floridanum* Banks proves to have a wide seasonal distribution, having been taken in mid-summer at Soledad, Cuba, and in November at Floreana in the Galapagos.

The female of *C. flavipes* is very unlike the male, as the abdomen extends in a prolongation above the spinnerets. In this respect it suggests Keyserling's figures of *Achæa* in his "Theridiidæ, 1884, 1, pl. 5."

The genus *Coleosoma* was based by O.P.-Cambridge in 1882 on the species *blandum* Camb. from Ceylon, also known only from the type, a male. Simon synonymized the genus with *Theridion*, a fact which has been the cause of some confusion. In 1884, Keyserling described and figured males, as *Coleosoma blandum* from the Marx Coll. taken at Enterprise, Florida. Mr. Banks noted the difference of his Florida specimens from the original description and in 1900, named the former *floridanum*. And in 1897, Simon reported as *Theridion blandum*, the

<sup>1</sup>Published with the aid of a grant from the Museum of Comparative Zoology, at Harvard College

Ceylon species, from St. Vincent, and casually stated that it was found in the tropics around the world. It is not improbable, that the species found on St. Vincent is either new, or one of the species found in Florida.

I wish to express here, my thanks to Mr. George Nelson for collecting at Sebastian; to Dr. William M. Barrows for generously allowing me to examine his collections from Fort Myers and to Mr. N. Banks for his encouragement and help.

Genus *Coleosoma* O.P.-Cambridge  
Proc Zool. Soc. London, 1882, p. 426.

*Cephalothorax* longer than broad, moderately convex, sloping gradually from eye area to posterior margin, thoracic groove punctiform; *eyes* rather small, anterior row recurved, eyes subequal and equidistant, posterior row procurved, lateral eyes touching; *clypeus* very high, convex; *mandibles* vertical, small and weak; *labium* wider than long; *maxillæ* narrow, inclined over labium; *abdomen* in male, long, usually constricted about middle, with a thin, bilobed, chitinized plate at anterior end that extends onto cephalothorax and continues on venter to about the middle of the abdomen; in female, the abdomen may be cylindrical, or produced in a tubercle above the spinnerets, the chitinized plate found in male, missing; *legs* in male, first pair very long.

Genotype; *Coleosoma blandum* Cambridge, male, Ceylon.

*Colcosoma* is separated from *Lithyphantes* by the higher, convex clypeus, slender mandibles, and the abdominal plate longer both on dorsum and venter. At present the genus consists of the genotype from Ceylon, and the three species described in this paper.

*Coleosoma flavipes* O.P.-Cambridge  
Figures, 1, 4, 7, 9

Biol. Centr. Amer., 1895, 1:154, pl. 19, fig. 12. "♂ Teapa, in Tabasco, Mexico; Guatemala."

Male. Length, 2.1 mm., ceph. 0.6 mm., abd. 1.5 mm. long, 0.4 mm. wide.

*Cephalothorax* grayish-brown, more than two-thirds as wide as long, (4.0:5.5), posterior margin about one half that of

anterior, sides evenly rounded, slopes gradually from eye area to posterior margin, thoracic groove punctiform, posterior margin indented with a chitinized hump on each lateral lobe, probably on which the abdomen rubs; *eyes* cover two-thirds of head, seen from above, anterior row recurved, eyes small, subequal and equidistant, posterior row slightly procurved, so that lateral eyes touch, eyes subequal and equidistant; *quadrangle* narrower in front and as high as width behind; *clypeus* strongly convex, more than twice as high as eye area, with no groove below anterior eye row; *mandibles* small, weak, vertical; *labium* wider than long; *maxillæ* more than twice as long as labium, inclined, tips almost touching; *sternum* brown, more than two-thirds as wide as long, convex, triangular, widest between I coxæ; *abdomen* cylindrical, black, constricted posterior to middle with constriction marked by a narrow white band, anterior portion larger, at base a thin, chitinized plate or sheath that extends in two blunt points over cephalothorax, and is continued on venter to fold, which is posterior to middle, dorsum with a few long colorless hairs, venter black, spinnerets at tip; legs, 1-4-2-3, long and very slender, I pair more than twice as long as entire spider, yellow with a black line on femora, tip of IV tibia and base of metatarsus dark, no spines but lines of colorless hairs; *palpus* longer than cephalothorax, dark, terminal joint very broad, embolus starts from lateral margin above in distal half, and almost completes a circle, tip with an abrupt turn, at end, a wide dark piece with an uneven tip.

Female. Length, 1.7 mm, ceph. 0.7 mm, abd 1.0 mm.

*Cephalothorax* not as wide as in male, a dull brown, with a narrow black marginal line; *eyes* same as in male; *abdomen* a dull gray, with a median dark stripe from pedicel to tip, sides a dull gray, abdomen prolonged in a slender conical projection, so that height above spinnerets equals length on venter from pedicel to spinnerets, venter dull gray from pedicel to spinnerets, fold much nearer pedicel than in male; *legs*, long, slender, pale; *epigynum*, area not quite as long as wide, two dark tubes beneath the skin, close together at anterior end, but separating near fold where a short median dark tube can be seen.

Allotype ♀ Florida; Fort Myers, 25 June 1941, M. C. Z. Coll.

2 ♂ Florida; Sebastian, March 1944, (Nelson)

♂ s ♀ s Florida; Fort Myers, 25 June 1941, Barrows Coll.

The specimens collected by Dr. Barrows at Fort Myers, show great variation in color among the males. Some have the cephalothorax pale yellow and the abdomen almost white with parallel stripes of gray; these have the legs about the same color as the cephalothorax, and either no dark stripe on the femora, or the stripes very indistinct. Other males are very dark, with the abdomen black as described by Cambridge, and the legs with dark lateral lines on the femora. All however, have the abdomen constricted just beyond the middle and a very broad palpus with the same corresponding parts. The females vary as much as the males. In some the abdominal tubercle above the spinnerets is reduced to a slight hump, while in others the tubercle is long, slender and pointed. All have the median dark line on the abdomen and the epigynum is the same. The coloring also varies. Some are quite dark with a darker median line on the abdomen; others are pale with the dark median line. The legs are usually white.

A lateral view of the abdomen of the female suggests some of the figures of *Achæa* given by Keyserling in the *Theridiidæ*, 1884, vol. 1. pl. 5.

### *Coleosoma floridanum* Banks

Figures, 3, 6

Can. Ent., 1900, 32: 98. "2 ♂ Florida; Punta Gorda."

*Theridion interruptum* Banks, Can. Ent., 1908, 40: 205, fig 9. "♀ Miami; Florida." (immature)

Male. Length, 2.0 mm., ceph. 0.6 mm., abd. 1.6 mm.

*Cephalothorax* brown, about two-thirds as wide as long, anterior and posterior margins about equal in width, sides evenly rounded, rather flat, slopes gradually from eye area to posterior margin, two small dark lobes near posterior margin, thoracic groove punctiform; *eyes* about cover anterior margin, anterior row slightly recurved, eyes equidistant, a.m.e. smallest of the eight, posterior row straight, eyes equidistant, lateral eyes touching on a low tubercle; *quadrangle* narrower in front, and as high as wide behind; *clypeus* vertical, slightly convex, with a groove below anterior eye row, about twice as high as eye area; *mandibles* vertical, small, weak; *labium* wider than long, fused to sternum; *maxillæ* fully twice as long as labium, inclined but tips not touching; *sternum* as wide as long, convex, dark about

margins; *abdomen* more than twice as long as wide, constricted posterior to middle, but constriction not as deep as in *C. flavipes* and divisions not as globose, anterior portion largest, pale brown, with lateral dark stripes which end before the constriction, a pair of irregular cream-color blotches on posterior slopes, constriction pale, posterior portion black with no markings, at the base, a thin, chitinized plate or sheath that extends in two blunt points over cephalothorax and extends on venter to fold which is posterior to middle, venter pale; *legs* much broken, 1-4-2-3, pale, a dark line on posterior femora, tip of IV tibia and base of IV metatarsus dark, I pair about one and a half times length of spider, no spines, but lines of long hairs, *palpus* not as long as cephalothorax, pale, embolus much shorter than in *C. flavipes*, embolus starts from near base and completes about half a circle, the dark piece at tip quite narrow, extends beyond the cavity, below a larger pale piece also extends beyond the cavity.

Female. Length, 1.8 mm.

*Cephalothorax* and *eyes* same as in male; *abdomen* cylindrical, three-quarters as wide as long, overlapping cephalothorax, but with no chitinized plate as in male, two widely separated, parallel dark stripes broken about middle, with paired white flecks in area between, pale flecks on sides; *legs*, 1-2-4-3, pale, with a dark ring at distal end of tibiae and distal end of IV femur, rows of bristles on all joints and a long dorsal bristle on tibiae; *epigynum*, a broad median septum with large openings each side.

Holotype 2 ♂ Florida; Punta Gorda, (Mrs. Slosson), Banks Coll.

Allotype ♀ pullus, Florida, Miami, February-March 1903, (Comstock), Banks Coll.

3 ♂ s 1 ♀ Florida; Fort Myers, February 1930, Barrows Coll.

♂ s ♀ s Cuba, Havana, Banks Coll.; Soledad, July-August, 1931, (Banks and Worley)

1 ♂ ♀ s Galapagos Islands; Floreana, 12-14 November, (Norge Exped.)

The male of *Coleosoma floridanum* is easily separated from the other two species of the genus, as the embolus completes about half a circle instead of almost a complete circle. The



female can be separated from the other two, by the much simpler epigynum. The parts of the epigynum are very lightly chitinized in all the specimens seen but apparently are the same in all specimens from Cuba or from the Galapagos Islands. The specimen figured is from Fort Myers, Florida.

*Coleosoma normale* spec. nov.

Figures, 2, 5, 8, 10

Male. Length, 1.5 mm., ceph. 0.5 mm., abd. 1.1 mm.

*Cephalothorax* pale, with a narrow dark marginal line and shaded with gray posterior to eyes, rather low and flat, three-quarters as wide as long, anterior margin much narrowed; *eyes* about cover anterior margin, anterior row recurved, eyes subequal, a.m.e. diurnal, separated by less than a diameter, little nearer to a l.e., posterior row about straight, eyes equidistant, p.m.e. largest separated by more than a diameter, lateral eyes touching, *clypeus* vertical, only slightly convex, less than twice the eye area; *mandibles* pale, vertical, weak; *labium* pale, wider than long; *maxillae* inclined, *sternum* triangular, dark about margins; *abdomen* pale, with two parallel dark stripes from base to spinnerets, stripes quite narrow about middle and heavier at ends, cylindrical, about half as wide as long, no indication of a constriction, chitinized basal plate narrow but divided at base into two blunt points and extends on venter to about the middle, venter pale yellow, margined with black, black about spinnerets; *legs*, broken, pale, with no indications of dark stripes or rings, no spines; *palpus* about as long as cephalothorax, pale, terminal joint very large, broad, embolus starts from side near tip, follows contour to tip, forming almost a complete circle, a pale club-shaped piece opposite bulb rests against the large black conspicuous piece at tip of bulb.

Female. Length, 1.6 mm., ceph. 0.5 mm., abd. 1.3 mm.

*Cephalothorax* and *legs* same as in male; *abdomen* cylindrical, with no indication of the chitinous plate found in male, pale, with two widely separated parallel dark stripes from base to spinnerets as in male, venter with median dark gray spot that reaches spinnerets; *epigynum* large for the size of the spider, a convex chitinized plate, beneath which can be seen the convolute tubes that almost touch at anterior end and are widely separated at posterior.

Holotype ♂ Florida; Fort Myers, 25 June 1941, M. C. Z. Coll.

Allotype ♀ Florida; Fort Myers, 25 June 1941, M. C. Z. Coll.

Paratype ♀ Florida; Fort Myers, 25 June 1941, Barrows Coll.

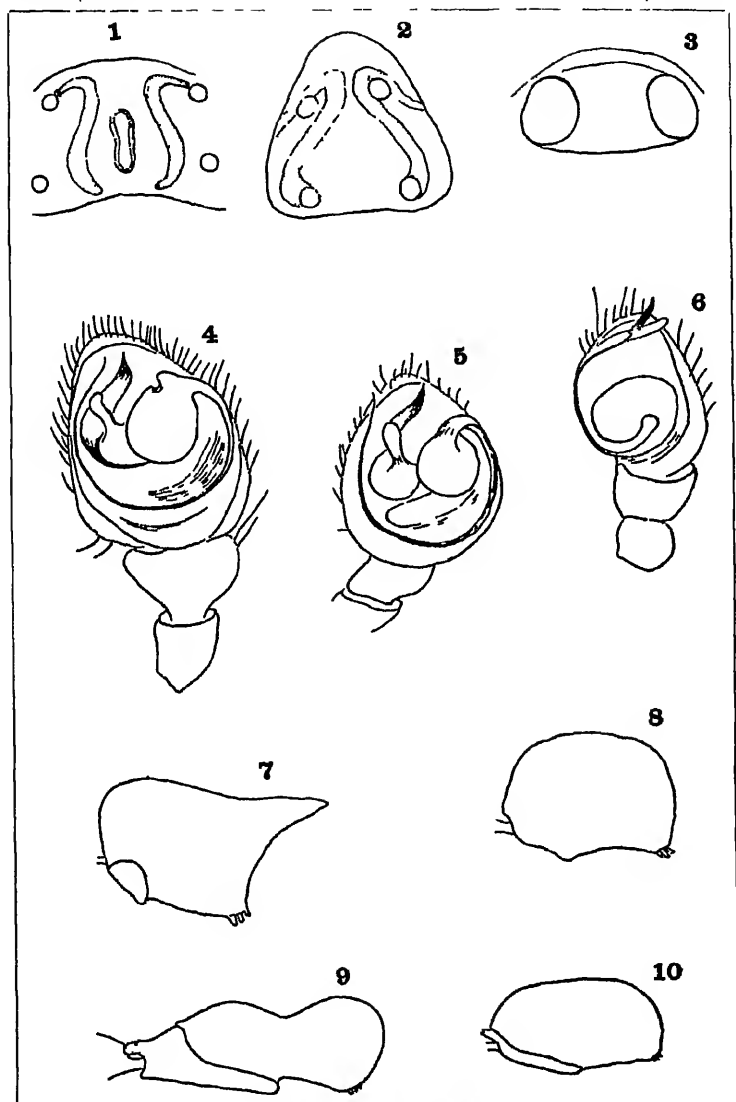
The male of this species has no constriction of the abdomen and the thin chitinous plate at the anterior end of the abdomen is much shorter in proportion than in the other two species. The female has the same markings on the abdomen and lacks the chitinized plate at the anterior end. The epigynum is similar to that of *C. flavipes* Camb but the openings are widely separated.

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#### EXPLANATION OF PLATE I

- Fig 1 *Coleosoma flavipes* Camb, epigynum  
 Fig 2 *Coleosoma normale* spec nov, epigynum  
 Fig 3 *Coleosoma floridanum* Banks, epigynum  
 Fig 4 *Coleosoma flavipes* Camb, left palpus  
 Fig 5 *Coleosoma normale* spec nov, left palpus  
 Fig 6 *Coleosoma floridanum* Banks, left palpus  
 Fig 7 *Coleosoma flavipes* Camb., lateral view of abdomen, female  
 Fig 8 *Coleosoma normale* spec nov, lateral view of abdomen, female  
 Fig 9 *Coleosoma flavipes* Camb, lateral view of abdomen, male.  
 Fig 10 *Coleosoma normale* spec nov, lateral view of abdomen, male







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SYSTEMATIC NOTES ON THE GENUS  
PSEUDOMYRMA<sup>1</sup>BY E. V. ENZMANN<sup>2</sup>  
The Haskins Laboratory

The genus *Pseudomyrma* is one of the most difficult of the genera of the family Formicidae and few systematists have attempted to explore the intricacies of its classification.

The genus was created by Latreille, 1831, up to the middle of the past century only a few forms were known of which Fabricius described two and Guérin and Spinola each contributed two more. The genus began to suffer from a sort of abnormal growth due to the writings of F. Smith who added some forty new forms, most of them badly characterized. In one case Smith illustrated the description of a *Pseudomyrma* with the drawing of an *Eciton*. The resultant chaos discouraged many later writers, a fact which can be readily seen by a perusal of the small list of later contributors. Thus, Mayr described 7 forms, Roger 4, Emery 15, Forel 78, Wheeler 6 and Santschi 16. In addition, Buckley, Norton, Wasmann and Aquayo each described one, Mann and Sitz described two each, and Wheeler in collaboration with Mann added four more.

Through the kindness of Professor Banks, Curator of the Entomological Collections of the Museum of Comparative Zoology, Harvard University, we are in the fortunate position of having access to the large collection, which is mainly built around Wheeler's material, many of the types and identified specimens are available here.

The Haskins Collection contains an additional number of

<sup>1</sup> Published with the aid of a grant from the Museum of Comparative Zoology at Harvard College.

<sup>2</sup> Mailing address: The Biological Laboratories, Harvard University.

types and identified specimens. The two collections between them contain specimens of nearly half of all the described species and varieties.

Following Forel's example we have disregarded a number of inadequately described forms, mostly those of F. Smith. Forel's viewpoint on Smith's work is given in the following quotation:

"F. Smith hat eine grosse Anzahl Arten dieser Gattung (*Pseudomyrma*) moeglichst oberflaechlich, fast ausschliesslich nach der bei den verschiedenen Individuen ungemein variierenden Farbe beschrieben. Es folgt daraus, dass die Mehrzahl seiner Arten unentwirrbar ist. Was bis jetzt entrastelt werden konnte ist von Mayr, Emery und mir klargestellt worden. Den Rest muss man ignorieren, oder man muss auf die Beschreibung und Neubenennung von *Pseudomyrma*-arten verzichten. Ich will nun das erstere tun."

Emery, 1895-1897, *Zool. Jb. Syst.*, expresses similar views.

Forel however can not be absolved from adding to the difficulties of the systematics of *Pseudomyrma*. He described a very large number of new forms, mostly subspecies and varieties, based on minute differences, but failed to arrange his and the previously described forms and integrate them into a system. He was able to do this only because of his remarkable knowledge, which prevented him from making mistakes and duplications.

Emery in his catalogue (*Gen. Ins.* 1921-23) made some attempt to arrange the known forms of *Pseudomyrma* which at his time of writing numbered nearly two hundred. He split the genus into three groups: *gracilis*, *tenuis* and *divers*, only one of which — *gracilis* — was characterized by him.

In the present account we have divided *Pseudomyrma* into five branches and each of the branches into numerous groups wherever possible. The terms "branch" and "group" were chosen deliberately and are employed in the same sense in which Emery used the term group, to denote a classificatory category which can not be sharply characterized, *i.e.*, where there are too many intergrades to permit the use of such terms as genus or subgenus.

This paper contains the descriptions of a number of new *Pseudomyrma* which the late W. M. Wheeler had named and labelled as types and cotypes, but whose descriptions have not been published. Professor Brues and Professor Banks have

advised us to include these descriptions in this paper.

Other undescribed forms were found in the unidentified material of the collection of the Museum of Comparative Zoölogy; the remainder of the newly described forms are material collected by us and for us in Central and South America.

### Genus *Pseudomyrma* (Latreille).

*Pseudomyrma* is the only American genus of Forel's *Promyrmicinae* (*Promyrmicini* of some writers), which includes the following tribes and genera:

- I. Tribe *Metaponini* Forel
  - 1. Genus *Metapone* Forel
- II. Tribe *Pseudomyrmini* Forel
  - 1. Genus *Sima* Roger
  - 2. Genus *Pseudomyrma* Latreille

### *Branches*.<sup>3</sup>

Branch *Ornatinodea*. Pl. II, fig. 1, 2; Pl. III, fig. 1, 2, 3.

Characters: The petiole with angular or rounded projections above and behind; or deeply excavated above; or with longitudinal or transverse impressions. This branch corresponds roughly to Emery's group *tenuis*.

Type: *Pseudomyrma tenuis* (Fabricius).

Groups: *excavata*, *tenuis*, *picta-schuppi*.

Branch *Clavanoda*. Pl. II, fig. 3, 4, 5, Pl. III, fig. 15;

Pl. IV, fig. 26-35.

Characters: The petiole is clubshaped, with a long thin peduncle in front, and is not or only weakly margined at the sides. This branch corresponds to Emery's group *gracilis*.

Type: *Pseudomyrma gracilis* (Fabricius).

Groups: *laevigata*, *solisi*, *mutica*, *gracilis*.

Branch *Triangulinoda*. Pl. II, fig. 6-12.

Characters: The pedicel from above has approximately the shape of a triangle, usually with rounded corners and convex sides; the peduncle is much shorter than in the preceding branch. The node is margined or submargined in some of the forms.

Type: *Pseudomyrma spinicola* Emery.

Groups: *dolichopsis*, *sabanica*, *championi*, *spinicola*, *elegans*.

<sup>3</sup> An explanation of this term has been given on p 60

Branch *Apedunculata*. Pl. II, fig. 13-15.

Characters: The petiole rises from the articulation with the epinotum in a straight line or in a convex line, *i. e.*, the node extends clear to the articulation and the peduncle is not differentiated; the node is usually strongly margined and sometimes the lower face of the petiole in profile is concave.

Type: *Pseudomyrma sericea* Mayr.

Groups: *subtillissima*, *sericea*, *acanthobia*, *elongata*, *filiformis*, *fiebrigi-brunnea*.

Branch *Latinoda*. Pl. II, fig. 17-22.

Characters: The peduncle is very short and notably broadened; the node is short and broad, sometimes broader than long; it is usually not margined at the sides

Type: *Pseudomyrma latinoda* Mayr.

Groups: *triplaridis-maligna*, *arboris-sanctæ*, *damnosa-latinoda*, *canescens*.

# KEY FOR THE IDENTIFICATION OF THE WORKERS OF PSEUDOMYRMA<sup>4</sup>

## Branches of *Pseudomyrma*

1. The pedicel is ornamented with spines or cones or carinae on the posterior face, or with longitudinal impression or suture *Ornatinoda*, Pl. II, fig. 1, 2, 3; Pl. III, fig. 1  
The petiole is not ornamented 2
2. Petiole usually very long, club shaped, not marginate or submarginate *Clavanoda*, Pl. II, fig. 4, 5  
Petiole not distinctly club shaped 3
3. Petiole from above triangular in outline; marginate or not marginate; usually with a peduncle. The species which have the petiole triangular but the peduncle very short and broad (*canescens*, Pl. II, fig. 18), have been included in *Latinoda* *Triangulinoda*, Pl. II, fig. 6-13  
Petiole from above not triangular 4
4. Petiole from above convex at the sides, usually broadest in the posterior third; sometimes subtriangular, but always lacking a differentiated peduncle, *i. e.*, the anterior face

<sup>4</sup>This key can not be used generally for the identification of the females and males, although it is often possible to place the former by means of it. No attempt was made at completeness, because the main purpose of the key is to indicate clearly the position of the newly described forms.

of the petiole in profile is straight or even convex

*Apedunculata*, Pl. II, fig. 13-15

Pedicel of different shape; with the node transversely oval, or trapezoidal, or globular, or triangular, but always with a very broad and short peduncle

*Latinoda*, Pl. II, fig. 17-22

*Detailed keys to the groups and species*

BRANCH ORNATINODA

1. Pedicel in profile long and low, with the upper border almost horizontal Pl. III, fig. 3 *tenuissima* Emery  
Petiole in profile higher 2
2. Pedicel in profile with a high rounded node. Pl. III, fig. 1  
group *excavata*  
Petiole in profile with a sharp or blunt superior-posterior corner. Pl. III, fig. 2.  
A. — Posterior face of the node straight. Pl. II, fig. 2  
group *tenuis*  
B. — Posterior face of the node convex

group *picta-schuppi*

The group *picta-schuppi* is transitional to the branch *Latinoda* and some of its forms are listed there. We include under *Ornatina* the following additional forms:

1. *gebella* — which has a transverse suture on the petiolar node.
2. *excissa* — the node with a strong semilunar excavation.
3. *schuppi* var. *geraensis* — which has the node excavated on top

The remaining forms of *schuppi* we have placed near *belti*, following Forel

Group *tenuis*

1. *tenuis*, typical. Length 5 mm. Entirely yellow-ochrous; sides of the head very convex; basal face of the epinotum with a longitudinal impression; node from above long and narrow; prothorax strongly marginate. Maranho, Brazil.
2. var. *paraensis*. Length 5 mm. Yellowish; mesonotum broader than long (as long as broad in the type); node with rounded angles instead of sharp corners; posterior face of node a little convex. Para, Brazil.

3. var. *pittieri*. Length 6 mm. Reddish brown, abdomen brownish. Costa Rica
4. subsp. *ingripes*. Color ferruginous red, head black. Brazil, Peru
5. var. *andina* var. nov. Length 5 mm. Reddish yellow; sides of the pronotum coarsely sculptured (finely punctate in the type) Peru.
6. var. *guatemalensis* var. nov. Length 6 mm. Reddish yellow; head brown; prothorax and mesothoracic disc both broader than long; petiolar node without horns or cones, but sharply raised brown margins. Guatemala.
7. var. *rufa* (redescribed as *P. rufa* by Mann, 1916). Length 6 mm. Color ferruginous; meso- and epinotum infuscated. Pará, Brazil.

## BRANCH CLAVANODA

1. Monocolored forms 2  
Bicolored forms 3
2. Yellow colored . group *laevigata-solisii* (see below)  
Color brown to black.
  - A. *unicolor* (syn of the type and monochroa); black.
  - B. *alfari*. Brownish yellow; length 4.1–4.8 mm.; peduncle short.
  - C. *duckei*. Length 3.5–4 mm.; peduncle short and indistinct; this form is transitional to *Apedunculata*.
  - D. *nigropilosa*. Length 6 mm.; testaceous yellow with black hairs.
3. Larger forms; 11 mm. or larger:
  - A. *gracilis* var. *major*. Yellowish red, head and abdomen black.
  - B. *mutilloides*. Black, except the peduncle which is red. Smaller forms; usually under 9 mm. 4
4. Thorax not impressed at the mesepinotal suture, which is very faint; length 5.6–6.3 mm.; head black, rest of the body reddish brown. The color is however variable *salvini*
  - Thorax not impressed 5
5. Peduncle very short; length 6.5 mm. Pedicel and gaster brown, rest of the body black *godmani*  
Peduncle longer 6





Group *lævigata-solisii*

1. *lævigata* type. Length 8.5 mm.; with fine punctation, body very shiny, color testaceous yellow.
2. subsp. *kitschelti*. Length 9 mm., head less convex than in the type, epinotum not narrowed behind.
3. subsp. *osuna*. Length 7.2 mm., head longer than in the type, longer than broad, base of the epinotum more convex than in the type and in *kitschelti*; color reddish yellow.
4. subsp. *insularis* subsp. nov. Smaller than the type and with abundant golden hairs (the pilosity in the type is sparser and black).
5. *P. solisii*. This species is intermediate between *Clavanoda* and *Triangulinoda*. We have put it into the latter, because of its short peduncle. It may be considered the extreme border case of this group (*lævigata*).
6. *flavidula*. Pl. III, fig. 15. Entirely smooth and shiny, yellow colored; head broader than in *pallida*; abdomen with a brown spot of variable size. Texas to Brazil.
7. *flavidula* var. *pallida* (formerly *pallida*); very close to the preceding, but the abdomen is not spotted. Florida to Mexico.
8. *flavidula* var. *jaumei*. Length 4 mm., close to the variety *pazosi*, but with the head shorter and less convex; gaster shiny and black; rest of the body dark red. Cuba.
9. subsp. *levivertex*. Color reddish yellow; first petiolar node more sharply bordered than in the type; abdomen banded brown. Argentina.
10. subsp. *lizeri*. Length 6 mm.; abdomen spotted, thorax tinted brown, clypeus not toothed (toothed in *levivertex*).

## BRANCH TRIANGULINODA

## Pl. III, fig. 6-10

1. Pedicel in profile less than twice as long as high; peduncle barely indicated by a concave anterior border of the node. Pl. III, fig. 4. 2  
     Pedicel in profile more than twice as long as high; peduncle well developed and long. Pl. III, fig. 7. 4
2. Thorax without impressed mesepinotal suture; length 6.5 mm.; pronotum margined; epinotum and first node reddish, postpetiole and abdomen brown or black.

Guatemala (Differs from the related form *antiguana* by the shorter peduncle.) *stolli*

Mesepinotal suture impressed 3

3. With a small antero-ventral tooth on the petiole. Pl. III, fig. 8. group *dolichopsis*

A. Larger forms, 4.3–5 mm.:

I. *dolichopsis*. The node in the typical form is very broad and convex on the sides. Colombia.

II. var. *curacænsis*. Length 4.3–5 mm.; color testaceous, brown in the type. Curaçao.

III. var. *implicata*. Length 4.3 mm.; head narrower than in the type; erect hairs absent on the femora. Amazonas.

B. Smaller forms: Length 3.6–3.9 mm.; scapes longer than in *dolichopsis*; reddish yellow or brownish. Guatemala. *peperi*

With larger antero ventral tooth and with a postero ventral tooth; the two teeth connected by a lamina. Pl. III, fig. 4. group *championi-denticollis*

A. *denticollis*, type and varieties; length 5–7 mm.; uni-colored or not.

I. *denticollis* type. Length 6–7 mm.; reddish; Paraguay. Pl. III, fig. 5.

II. var. *infuscata*. Length 5–6.2 mm.; head brown, gaster testaceous, sometimes the whole body brown. São Paulo, Brazil.

B. *gældii*. Length 3.2–3.5 mm.; pronotum red, rest black. São Paulo.

C. *rochai*. Length 4–4.7 mm.; head bright red, rest of the body black

D. *championi* and subspecies. Pl. III, fig. 4. Length 4.5–5.5 mm.; antero ventral tooth strong and curved backward.

I. *championi* type. Thorax and petiole red, rest blackish brown; length 4.7 mm.

II. var. *haytiana*. Same color as the type, but the antennæ are bright yellow; postpetiole and gaster with reddish spots.

III. subsp. *haytiana* var. *affinis*. Head black, epinotum with a black streak in the center; pedicel and gaster brown.

- IV. subsp. *haytiana* var. *torquata*. Head to post-petiole black, except the pronotum, which is bright red
  - V. subsp. *haytiana* var. *paulina*. Transitional to subsp. *incertus*
  - VI. subsp. *incertus*. Length 4.6–5.3 mm.; brown as in *torquata* but the node is three times as long as broad.
4. Unicolored forms Pl. II, fig. 6. group *sabanica-pallens*
- A. *depressa*. Length 4.3 mm.; thorax strongly compressed; color brownish black; head as long as broad, with convex sides; smooth and shiny. Colombia
  - B. *kuenckeli*. Pl. II, fig. 10. The node from above forms a short triangle.
    - I. *kuenckeli* type. Color reddish testaceous, gaster brownish. Costa Rica
    - II. var. *bierigi*. Length 5 mm., darker than the type, nearly black; head ferruginous. Panama.
    - III. var. *dichroa*. Larger than the type and more robust; head yellowish red, thorax yellow in front, rest of the body brown. Colombia.
    - IV. var. *honduriana*. Head reddish brown, thorax dark reddish, gaster brown. Honduras.
- (The varieties of *P. kuenckeli* are separated mainly by their color patterns; we have not enough material on hand to determine how real these differences are.)
- C. *sabanica* type. Color dark brown (Pl. II, fig. 6) and the variety *saffordi* length 3.4–4 mm.; color uniformly brown, lighter than in the type.
  - D. *pallens* type. Length 5–6 mm.; color testaceous; pilosity sparse; pubescence moderate. Colombia.
    - I. var. *gibbinoda*. Mesonotum very convex (in the type it is straight and forms an acute angle with the base); São Paulo.
    - II. var. *landoldti*. Length 6 mm.; reddish yellow; first node much broader than in the type. Colombia.

Bicolored forms

5

5. Thorax without mesepinotal constriction

*antiguana* sp. nov.

- I. *antiguana* type. Length 5 mm.; reddish brown, head and gaster slightly darker Guatemala.
- II. var. *brunnipes* var. nov. Length 6 mm ; sides of the thorax and petiole bright yellow contrasting sharply with the dark brown legs. Guatemala.

Thorax with a pronounced mesepinotal constriction 6

6. Smaller forms. Pl. III, fig. 7. group *spinicola*

- A. *edvardi* type. Color black and the variety *cæcilix*. Black as the type; length 2.9–3 mm Differs from the type by the straight posterior edge of the head (concave in the type).
- B. *ejecta* type. Length 1½ lines. Color rufo-testaceous, gaster black, and the variety *peruviana*. Same size as the type; head to mesothorax testaceous, rest of the body rich castaneous
- C. *distincta* type. Close to *ejecta* but with the head black, and the variety *pulchella*. This variety is listed under the larger forms below.
- D. *mutica*. Length 5.2–6.2 mm ; rusty red, head and gaster brown, peduncle nearly obsolete. This form is transitional to *Apedunculata*. It is distinguished by having the posterior face of the first node vertical as in *denticollis*.
- E. *kurokii*. Length 4.6 mm.; reddish brown, gaster brown, and the variety *rufiventris*. Length 6.1 mm. (only the female known).
- F. *solisii* type. Length 4 mm. Near *mutica* but with the head more convex; petiolar node evenly rounded and the variety *belgranoi*. Length 5 mm.; differs from the type in the shape of the petiole.

The species *mutica* and *solisii* are transitional to *Clavonoda* and are listed again under that branch.

G. *spinicola*. Node rounded, without antero-ventral tooth. Pl. III, fig. 7.

- I. *spinicola* type. Length 4–5.5 mm.; testaceous, gaster darker.
- II. var. *convarians*. Length 3.6 mm.; head shorter than in the type.
- III. var. *gaigei*. Length 4.5–5.2 mm.; color vividly red.

IV. var *atrox* Length 4-4.7 mm ; head almost as broad as long

V var *infernalis*. Differs from the type by lack of margination, from *convarians* by larger size, from *gaigei* by the narrow postpetiole and from *atrox* by the nonenotched clypeal lobe.

VI. var. *sclerosa*. Very near to *infernalis* but with the mesonotal disc more elevated (low in *infernalis*).

Larger forms. Pl. II, fig 7 group *elegans*

A *auripes*. Length 8 mm.; color blackish brown with yellow legs, contrasting sharply

B *distincta* var *pulchella* (see also under *spinicola*). Head and abdomen black, thorax and pedicel ferruginous red, length 8 mm

C *elegans* type. Head and abdomen black, thorax and pedicel ferruginous red. Length three lines (about 8 mm ), and the variety *breviceps* Head shorter than in the type; petiole narrower with less margination; petiole and thorax deep red with brown spots (The differences given in Forel's description warrant raising the variety to the rank of a species We have not seen the type of the variety )

#### BRANCH APEDUNCULATA

1. Petiole in profile less than twice as long as high. Pl. III, fig. 10. 2

Petiole in profile more than twice as long as high. Pl. III, fig. 18.

2. Very slender forms with long and narrow head.

A. *subtillissima* type. Length 3-3.5 mm ; color testaceous. Costa Rica (The variety *tenuissima* has been raised to species rank and listed under *Ornatinoda*.)

B. *voytowskii*. Length 2.2 mm.; occiput transparent; prothorax yellow, rest of the body brown, Peru, and the variety *costariensis*. Length 4.2 mm.; head reddish brown; opaque (shiny in the type). Costa Rica.

More robust forms 3

3. Petiole with backwardly directed antero-ventral tooth. Pl. III, fig. 10.

A. *wessoni*. Length 3.5-4 mm.; uniformly yellow; pedi-

cel and gaster shiny, rest of the body opaque. Peru. Pl. III, fig. 10. The variety *tuberculata*. Epinotum with small tubercles at the junction of the base and the declivity. Pl. III, fig. 12. The type lacks the tubercles.

B. *allidora*. Length 3–3.5 mm.; intermediate between *sericea* and *acanthobia* in the shape of the petiole; differs from the former by its brown color, from the latter by the absence of erect hairs. Panama.

C. *weberi*. Length 3.8–4 mm.; head reddish brown, weakly bicolored on the rest of the body; this species is easily recognized by the peculiar shape of its petiole in profile. Pl. III, fig. 16. It is transitional to *deciens*.

Petiole with a triangular lamella in place of the antero ventral tooth. (Some forms have a tooth, i.e., *sericea fortis*.) Pl. III, fig. 17. 4

4. With an antero ventral and a posterior tooth, the two teeth connected by a serrated lamina. Pl. III, fig. 19. 5

Without a posterior tooth, but the lamella is present. Pl. III, fig. 20. Color brown 6

5. All forms belonging here are black or very dark brown and all have a silky shine.

A. *sericea* type. Length 4.5–5.5 mm.; Colombia. Pl. III, fig. 11.

B. var. *altinoda*. Length 4 mm.; petiole higher than in the type, two-thirds as high as the thorax; differs from the type in color. Brazil.

C. var. *cordiae*. Smaller than the type; clypeal lobe triangular. Peru.

D. var. *fortis*. Length 6 mm.; base of the epinotum longer than the declivity. Mexico.

E. var. *huberi*. Length 4.5 mm.; abdomen grayish, otherwise as in *rubiginosa*.

F. var. *ita*. Length 4.5 mm.; the first node has a very convex anterior face, the second node is smaller than in the type. Costa Rica.

G. var. *longior*. Length 5.5–6 mm.; clypeal lobe triangular; color as in *fortis*. Brazil

H. *rubiginosa*. Head black, front of pronotum deep

brown, first node banded with brown, abdomen black, rest of the body rusty red. Brazil.

- I. var. *vinem*. As in cordiae, but with larger eyes; base of the epinotum very convex, length 3.5–4.5 mm. Brazil.

- K. var. *acaciorum*. Length 3.5–3.8 mm, chocolate brown; clypeal lobe rounded, coloration distinctive. Panama.

- L. var. *lisa*. Near *acaciorum*, but with the sides of the thorax smooth (punctate in *acaciorum*); color scheme more vivid.

6. Light brown forms; *acanthobia* and varieties

- A. *acanthobia* type. Reddish yellow with brown spots on the abdomen; pronotum not marginate. Paraguay. Pl. III, fig. 13.

- B. var. *capperi*. Differs from the type by having the first node margined. Jamaica.

- C. var. *cocæ*. Smaller than the type, length 5.5–6 mm.; sculpture coarser. Argentina.

- D. var. *fuscata*. Darker colored than the type. Paraguay.

- E. var. *panamensis*. Length 4 mm; petiole shorter than in the type.

- F. var. *virgo* Sant. Length 3.5 mm.; yellowish, gaster not spotted. Brazil.

- G. subsp. *deliculata*. Length 3–3.5 mm.; pedicel very narrow compared with the width of the thorax, brownish yellow with brown spots on the abdomen. Jamaica. Pl. III, fig. 13.

- H. subsp. *deliculata* var. *vittata*. Length 3.4–4 mm.; with brown bands on the second and third gastric segments. Brazil.

- I. subsp. *deliculata* var. *limai* var. nov. Length 2–3 mm.; very shiny; occiput transparent; abdominal spots very small. Peru.

Dark brown to black forms:

- A. *elongata* type. Length 3–4.5 mm; head narrowed behind; color dark brown to black. Colombia. Pl. III, fig. 12.

- B. var. *tandem*. Head shorter than in the type; petiole thinner. Costa Rica.

- C. var. *subatra*. Length 4–4.5 mm.; head shorter than in the type; epinotal base shorter; sculpture coarser than in the other varieties. Haiti.
7. Color dark, brown to black group *febrigi-brunnea*.
- A. *febrigi*. Length 3.7–4 mm., blackish brown to black; pronotum bluntly margined. Paraguay.
- B. *culmicola*. Length 3 mm.; reddish brown, abdomen brown; close to the type but with thicker antennæ and a smaller petiole. Trinidad
- C. *holmgreni*. Length 4.2 mm.; testaceous brownish yellow, gaster brown. Peru.
- D. *curyblemma*. Length 5 mm.; pronotum not margined; reddish brown. Costa Rica
- E. *peltata*. Length 6.8 mm.; ferruginous red; peduncle long. This form is transitional to *Clavanoda*.
- F. *brunnea*. Length 2.5–3 mm.; head with nearly parallel sides; color dark brown, gaster blackish.
- G. *brunnea* var. *nigrita* var. nov. Head opaque (shiny in the type); black with white mandibles.
- H. *colci* sp. nov. Length 4.5 mm.; nearly naked; head and prothorax reddish brown, gaster black. Peru.
- I. *colci* var. *vistana* var. nov. Head bright reddish, occiput dark brown, petiole and gaster dark brown. Peru.
- Color lighter, light brown or yellow 8
8. Petiole in profile very long *filiformis* and varieties
- A. *filiformis* type. Length 4–5.5 mm.; head yellowish red, gaster brown. Guatemala. Pl. III, fig. 18.
- B. var. *longiceps*. Larger than the type; head much longer. Colombia.
- Petiole in profile shorter 9
9. Petiole in profile with a small antero ventral tooth
- decipiens*
- A. *decipiens* type. Length 5–7 mm.; node transitional to *salvini* and *gracilis*; reddish yellow; base of the abdomen banded brown.
- B. var. *longior*. Length 6.4–6.7 mm.; head longer than in the type; first node higher.
- Petiole without a tooth below. Pl. III, fig. 14 *nigrocincta*
- A. *nigrocincta* type. Length 4–4.5 mm.; yellow, with fuscous spots on the abdomen. Costa Rica.



- B. var. *bicincta*. Head rectangular (narrowed behind in the type); base of the petiole and gaster brown.

# BRANCH LATINODA

1. Color bright yellow, last gastric segment brownish; petiole stout with a short peduncle and a round node, rising sharply from it. Trinidad. Length 6 mm. *icterica*  
Color darker 2
2. Petiole below without or with a very small antero ventral tooth. Pl. III, fig. 23 3  
Petiole with a large tooth and usually with a broad lamella except in *maligna-cholerica*, which lacks the tooth. Pl. III, fig. 20 7
3. Head oval, not longer than broad. Pl. III, fig. 23 *belti*  
A. *belti* type. Length 5-6 mm.; petiole with a small tooth, thorax narrowly margined. Costa Rica  
B. var. *obnubila*. Length 6-6.8 mm.; black; more robust than the type; peduncle longer and broader. Costa Rica.  
C. subsp. *fulvescens*. Color reddish testaceous, gaster brown, thorax flatter than in the type.  
D. subsp. *venifica*. Length 4-4.5 mm.; deep brown; petiole and gaster sometimes lighter; very hairy. Mexico.  
E. subsp. *bequaerti*. Length 5-6 mm.; head a little longer with convex sides; prothorax not marginate; differs from the other varieties by its uniformly brown color. Head a little longer than broad 4
4. Head narrowed behind; color uniformly dark brown; node almost as long as broad; petiole without a ventral tooth; very hairy *caroli*  
Head not narrowed behind 5
5. Clypeus in front with two blunt teeth, as in the genus *Sima*; length 6.5 mm.; petiole as broad behind as long; color brownish yellow. Amazonas. *simoides*  
Clypeus not with blunt teeth 6
6. Group *canescens*. Pl. III, fig. 22.  
A. *canescens*. Length 5.5-6.5 mm.; head longer than broad, with nearly parallel sides, antennæ surpassing the head. Mexico.  
B. *bradleyi*. Length 5.5 mm.; uniformly light brown;

prothorax not margined; node subglobular; petiole with a small tooth. Peru.

7. Petiole with a vertical posterior face and a lamina below, ending in front in a triangular tooth. Pl. III, fig. 21.

A. *picta* type. Length 5.5 mm., pronotum marginate; node from above trapezoidal and marginate, the margins ending behind in blunt teeth (transitional to *Ornatinoda*). Ground color red with a complicated black pattern superimposed. Brazil.

B. var. *humboldti*. Without postero superior teeth on the first node.

Petiole shaped differently 8

8. Petiole with a relatively long peduncle and a strong tooth, sometimes continued backward in a crenulated lamellæ.

Pl. III, fig. 19 group *tripларidis-maligna*

Petiole without peduncle, lamella not crenulated. Pl. III, fig. 20. group *arboris-sanctæ*

#### GROUP *TRIPLARIDIS-MALIGNA*

- A. *ulci*. Length 4–5 mm., mandibles angular near the base, head rectangular with nearly parallel sides; color as in *caroli*. Amazonas.

#### B. *maligna*

I. *maligna* type. Length 4–4.6 mm.; thorax submarginate; petiole from above globular; petiolar node abrupt behind; color deep castaneous. British Guiana.

II. var. *cholericæ*. Length 3–3.5 mm.; lighter colored than the type and weakly bicolored; without a ventral tooth on the petiole. British Guiana.

III. var. *crucians*. Length 3–3.5 mm., very dark brown, sometimes black. British Guiana.

- C. *tripларidis*. Head long and narrow; mandibles not lighter than the rest of the body as is almost invariably the case in *Pseudomyrma*.

I. *tripларidis* type. Length 4.5–4.8 mm., petiolar node from above subhexagonal. Amazonas.

II. subsp. *biolleyi*. Length 4.8–5.2 mm.; eyes smaller than in the type; node from above globular; head reddish brown, gaster brown, first gastric segment and rest of the body reddish. British Guiana.

- III subsp. *bovi* Length 4 mm, mandibles not darker than the head, color brownish yellow, sculpture stronger than in the other forms. British Guiana.
- IV subsp. *trigona* Length 4.4-4.8 mm., mesonotal disc angular as in the type, epinotum ovoid and convex. Color uniformly red. British Guiana.

#### GROUP ARBORIS-SANCTÆ

- A. *schuppi* and var. Antennæ beaded, frontal carinæ indistinct; close to *belti* in the shape of the head; length 4.5-5 mm. (the variety *geranensis* has the first node excavated above and is therefore transitional to *Ornatinoda*, where we have listed it)
- B. *oki*. Length 3.5 mm; like a small *belti* fulvescens; the clypeus without lobe, pronotum marginate, node as in *belti* but without a peduncle.
- C. *latinoda*. Pl. III, fig. 19.
- I. *latinoda* type. Length 4 mm, rufo testaceous; petiole very short. Brazil.
  - II. var. *endophyta*. Length 4.1-5.3 mm; more robust than the type; color reddish yellow. Brazil.
  - III. var. *nigrescens*. Length 4.4-4.8 mm.; petiole and thorax black, rest of the body reddish yellow; darker than the type. Brazil.
  - IV. var. *opacior*. Length 4.3 mm., pronotum gently sloping, not abrupt as in *nigrescens*; color uniformly brownish yellow. Cuba
  - V. subsp. *tachigalia*. Head longer than in the type, with parallel sides, clypeus with a rectangular lobe. Brazil.
  - VI. var. *coronata*. Length 5.5-6 mm; head testaceous with a brown spot on the occiput, rest of the body dark brown. British Guiana.
- D. *dendroica*. Close to *arboris-sanctæ*.
- I. *dendroica* type. Length 6.5 mm.; robust; pronotum marginate; color deep brown. Brazil.
  - II. var. *emarginata*. Head broader than in the type. Brazil.
- E. *arboris-sanctæ*. Pl. III, fig. 20.
- I. *arboris-sanctæ* type. Length 5.6 mm.; testaceous, head darker; first node very transverse. Bolivia.

- II. var. *cordobensis*. Length 6–6.5 mm.; head not concave behind as in the type; color reddish yellow. Argentina
- III. subsp. *symbiotica*. Length 4.4–4.7 mm.; color reddish yellow, middle of the gaster brown.
- IV. subsp. *symbiotica* var. *laewensohni* Length 5.5–5.7 mm., color reddish brown. Panama.
- V. var. *ecuadoriana* var. nov. Length 5.5 mm.; with a brown occipital spot; postpetiole more transverse than in the type; color reddish brown, first three abdominal segments banded brown. Ecuador.

*Pseudomyrma acanthobia*, subsp. *deliculata* var. *limai* var. nov.

Pl. IV, fig. 24.

Worker.

Length 2–3 mm. Close to the subspecies *deliculata* from which it differs by the following characters. The whole body, except the pedicel, very shiny (the subspecies is sublucid). Smaller and slenderer. The whole occiput is transparent showing the outlines of the brain (the type is a little transparent on the occiput). The scapes are shorter and fail to reach the middle of the eyes. The petiole is even more slender than in *deliculata* and is finely punctate and subopaque. The abdominal spots are barely visible, or absent in some specimens, while in *deliculata* they are dark brown and large. Described from several workers taken from an unspecified tree.

Type locality: Lima, Peru.

Holotype No. 75, Haskins Collection, located in the Biological Laboratories, Harvard University, Cambridge, Massachusetts.

*Pseudomyrma allidora* sp. nov.

Worker

Length 3–3.5 mm. The new species is intermediate between *P. acanthobia* and *P. sericea* in the shape of the pedicel. It differs from *P. sericea* by its lighter color and from *P. acanthobia* by the presence of erect hairs, a much longer head, coarser sculpturing on head and thorax, absence of brown spots on the abdomen, etc.

Head, without mandibles, about  $1\frac{1}{2}$  times as long as broad with nearly straight sides and weakly concave posterior border.

The eyes are flat and large, occupying more than half the sides of the head. The mandibles are yellow, with two large apical and three small basal teeth, all black, heavily striated. The clypeal lobe is rectangular and not excised. The scapes fail to reach the middle of the head. The head is evenly and densely punctate, opaque, devoid of erect hairs, but with fine white pubescence on the vertex. The prothorax is longer than broad, and distinctly margined on the sides, the mesonotal disc has an acute angle in front, behind it is semicircular. The epinotal base is longer than broad, broadest in front, narrowed behind, where it meets the epinotal declivity. The petiole is subtriangular from above, with convex sides and rounded posterior edge, the postpetiole is as long as broad and nodiform. The thorax in profile is slightly convex above with a strong depression at the mesepinotal suture. The base and the declivity of the epinotum meet at a rather sharp angle. The node in profile is shaped as in *P. sericea*; but has a pronouncedly backward curved antero-ventral tooth (the tooth is triangular in *P. sericea*).

The pilosity is sparse on the thorax, pedicel and abdomen, absent elsewhere. The pubescence is also sparse, except on the postpetiole and gaster, where it is relatively abundant, white and silky. The color is brownish-yellow, with the prothorax and petiole a little lighter; the head sometimes a little blackish. Mandibles and tarsi clear yellow.

Habitat: Ancon, Canal Zone (Type locality). On *Cordia allidora*. Miraflores, Canal Zone. On *Triplaris cumingiana*. The specimens from Miraflores have the gaster subopaque (shiny in the specimens from the type locality).

Cotype 20533, Harvard Collection, Mus. Comp. Zoölogy (21 specimens).

*Pseudomyrma antiguana* sp. nov.

Worker.

Length 5 mm. The whole body reddish brown, with the head and gaster dark reddish brown. Head and thorax densely and coarsely punctate, the rest of the body finely punctate and opaque throughout. The new form belongs to the branch Triangulinoda and is close to the bicolored species *spinicola*, which has a long peduncle with the faintest indication of an antero-ventral tooth, placed very close to the articulation with the epinotum.

The new form is sufficiently different from *spenicola* to be listed as a separate species. The structure of the thorax of the new species is in marked contrast to that of *P. spenicola*; it is evenly convex in profile, without any depression at the mesepinotal suture. From above this suture is very faint, nearly obsolete. The mandibles are almost as dark as the rest of the head, a feature which distinguishes *P. triplaridis*, which however belongs to another branch. The mandibles are curiously flattened, as if they had been artificially crushed, and strongly rugose, each ruga leading to a tooth. The frontal carinae are very close together.

Type locality: Antigua, Guatemala (Wheeler coll.).

Holotype No. 84, Haskins Collection; two paratypes.

*Pseudomyrma antiguana* var. *brunnipes* var. nov.

Worker.

Length 6 mm. With the general features of the type, that is the flattened mandibles and the very faint mesepinotal suture. It differs from the type by its shorter and more robust petiole, which has a shorter peduncle. The frontal carinae are longer and farther apart than in the type. The color pattern is very striking. The whole body, including the mandibles and legs, dark reddish brown and contrasting very sharply with the thorax and petiole, both of which are bright yellow on the sides and brownish yellow dorsally. The petiolar node is almost as dark as the postpetiole and gaster. The second abdominal segment has the anterior half golden yellow, the posterior half dark brown.

Type locality: San Lucas, Toliman, Guatemala (Wheeler coll.).

Holotype No. 85, Haskins Collection.

*Pseudomyrma arboris-sanctae* var. *ecuadoriana*, var. nov.

Worker.

Described from numerous workers collected for us in Ecuador. Length 5.5 mm. Head  $1\frac{1}{4}$  longer than broad, with very convex sides and straight posterior border. Mandibles very strongly striate, with two large apical and several small blunt basal teeth. The clypeal lobe is very short and rectangular. The scapes are much thickened apically and reach the middle of the eyes. Head densely foveolate, not punctate; on the occiput

with a brown spot around the ocelli. Prothorax as long as broad, not margined at the sides. Mesothorax with an almost circular disc which is a little elevated, separated from the base of the epinotum by a wide depression, the latter is longer than broad, broadest at the level of the stigmata, and very convex transversely. The petiole is shaped as in the type; the postpetiole is more transverse. The posterior edge of the first, second and third segments are brown, the tip of the gaster and the gaster below are brown. The rest of the body is reddish brown, except for the brown spot on the occiput.

Type locality: Ecuador.

The new form differs from the type *arboris-sanctæ* in coloration. The type has the anterior edge of the head and the prothorax light yellow, the mesonotal disc dark brown, and the occipital spot very small. The pilosity and pubescence is much more developed in the new variety, the eyes are larger and more convex. From the other forms of *arboris-sanctæ* the new variety differs by the characters given in the key.

Described from 5 workers in the Collection of the Museum of Comparative Zoology, labelled Cotype 26809.

*Pseudomyrma belti* subsp. *bequærti* subsp. nov.

Worker.

Length 5–6 mm Head a little longer than broad with very convex sides and straight posterior edge. Mandibles very shiny; clypeus with a short broad rectangular lobe in front; scapes reaching beyond the middle of the eyes. Eyes very large and convex, occupying more than half the sides of the head. Head coarsely and evenly punctate, with very sparse erect hairs.

Prothorax longer than broad, not margined on the sides. Mesothoracic disc triangular with well rounded angles. Epinotum about twice as long as broad. In profile the prothorax is slightly convex above, the epinotal base nearly flat; the base rounds into the declivity without an angle.

Petiole from above  $1\frac{1}{2}$  times as long as broad, the node broader behind than in front, the posterior edge rounded. Postpetiole about as broad as long, twice as broad as the petiole. In profile the petiole is  $1\frac{1}{2}$  times as long as high, with a very short peduncle; the node evenly rounded with the posterior face a little more abrupt.

Erect hairs sparse on thorax, pedicel and abdomen. Pubes-

cence long and adpressed, on the tibiae short and fine. Head to pedicel opaque, gaster subopaque. Color uniformly brownish yellow.

Type locality: Puerto Castillo, Honduras (Bequaert) In *Acacia*.

The new subspecies is easily distinguished from the type as well as from the other varieties and subspecies by its color. It is closest to the subspecies *fulvescens* Emery, which is reddish-testaceous with a darker abdomen. The pedicel from above in *fulvescens* is nearly triangular, with convex sides and blunt margin.

Cotype 23139, Harvard Collection, 8 specimens.

*Pseudomyrma belti* subsp. *venifica* subsp. nov.

Worker.

Length 4-5 mm. Head shaped as in the type. Mandibles faintly striated. Clypeus with a much narrower but rectangular lobe; front and clypeus with abundant pilosity. Prothorax about as long as broad, not marginate at the sides. Mesonotal disc transversely oval; epinotum nearly twice as long as broad, broadest at the level of the stigmata. The node from above shaped as in *P. decipiens* (Pl. II, fig. 13), not marginate at the sides. Postpetiole broader than long, more than twice as broad as the petiole. Abdomen very slender. Thorax strongly constricted between the meso- and epinotum, seen in profile. The epinotum is very convex, the base evenly rounded into the declivity, not forming an angle. The petiole in profile as in *P. belti bequaerti*.

Color deep brown, the prothorax and petiole and sometimes the gaster lighter brown.

Type locality: Manzanillo, Colima, Mexico. (Townsend).

Female.

Length 5 mm. The female is very distinctly bicolored with a reddish brown ground color; the prothorax, mesothorax (except the disc) and petiole very light brown to yellow.

This form is easily recognized by its extraordinarily long pubescence, especially on the pedicel, gaster and legs, which gives this ant a shaggy appearance. It is a transition form but nearer to *belti* than to *P. decipiens*.

Described from 20 specimens, labelled Cotype 20538, in the Collection of the Museum of Comparative Zoölogy.



*Pseudomyrma bradleyi* sp. nov.

## Worker.

Length 4.5-5 mm. Color uniformly light brown, or yellow brown except the mandibles, front of the head, tarsi and articulations of the legs, which are yellow. Differs from *P. latinoda* var. *coronata* by having the sides of the head nearly straight, so that the head seen from above is nearly a perfect rectangle; the antennæ are brownish, not clear yellow as in *coronata*. The prothorax is much narrower than long in the median line; the epinotum is almost flat transversely, broadest just behind the mesepinotal impression. The prothorax is not margined. The node of the petiole is subglobular, a little narrower in front. The postpetiole is shaped as in *coronata*. In profile the pro- and meso-notum together form a convex line, which is interrupted by the promesonotal suture. The base of the epinotum is straight and forms a blunt angle with the declivity. The petiole in profile has a very short peduncle, almost "apedunculate," with convex anterior and posterior faces, the latter more abrupt. There is no trace of margin on the node.

Pilosity practically absent on the vertex, thorax and petiole, sparse on the postpetiole, gaster and legs. The pubescence is moderately abundant, adpressed, fine and white. The whole body with very fine punctation, coarser on the head, and subopaque.

This form is close to *latinoda* but differs from it in several major characters, which justifies listing it as a separate species.

Type locality: Perene, Peru. (Bradley).

Cotype 22864, Harvard Collection, 6 specimens.

*Pseudomyrma brunnea* var. *nigrita* var. nov.

## Worker.

Similar to the type in size and structure and with the epinotal declivity much longer than the base (as in the type). It differs from *P. brunnea* by the much coarser sculpturing on the head and thorax, which renders it opaque (shiny in the type); the stouter body; the coloration which is black in the new variety, except for the mandibles, which are white and contrast strikingly with the rest of the head (mandibles yellow in the type). The head is long and narrow in the type while in the variety it is almost as broad as long.

Type locality: Mirador, Mexico.

Described from 3 workers, labelled Cotype 26810, in the Collection of the Museum of Comparative Zoölogy. The Haskins Collection has 6 workers from Camaron, Mexico.

*Pseudomyrma colei* sp. nov

Worker

Length 4.5 mm Head  $1\frac{1}{4}$  times as long as broad, broader in front, with very round occipital corners and straight posterior edge. Mandibles strongly striated, with two apical, but no basal teeth. The clypeus with a very short and narrow anterior lobe which is weakly excised in the middle. The eyes are about half as large as the sides of the head and are flat. The scapes reach the middle of the head. The head is finely punctate and shiny. Prothorax broader than its length in the midline, not margined, finely punctate. The mesothoracic disc is transverse. The base of the epinotum is twice as long as broad, broadest at the level of the stigmata, a little narrower at the junction with the epinotal declivity. The petiole from above is shaped as in *P. decipiens*. The postpetiole is  $1\frac{1}{2}$  times as broad as the petiole, broader than long, and nodiform. The thorax in profile is slender, a little convex above, strongly impressed at the mesepinotal suture. The base and declivity of the epinotum form a blunt angle. The petiole in profile is distinctive and separates this form from all other related species. It is twice as long as high and has four distinct faces; the slightly concave anterior face rises from a short peduncle; the superior face is convex and higher behind than in front; the posterior face is convex and abrupt and ends in a sort of posterior peduncle. Below, the petiole has a small blunt tooth, shaped as in *P. elongata*.

The new species is nearly naked: the pilosity is restricted to the mouth, and the extremely fine pubescence to the funiculi and the tarsi. Color: tibiæ antennæ, tarsi and tip of the gaster yellow. Head and prothorax reddish brown, the rest of the body almost black.

Type locality: Bella Vista, Peru (800 m sea level). Taken from an unknown tree.

Holotype No. 71, Haskins Collection.

*Pseudomyrma colei* var. *vistana* var. nov.

## Worker.

Described from a large number of workers, taken from the leaves of an unknown tree. The new form is almost identical with the type in structure, but differs markedly from it in coloration. The mandibles are very pale yellow, with black teeth. The head and antennæ are bright reddish-yellow, but all of the occiput, behind the eyes, is dark brown. The prothorax is yellow with a large brown spot in the middle; the mesonotum and epinotum are black; the pedicel and abdomen dark brown. The middle and hind coxæ and the middle swollen parts of the femora are reddish brown, the rest of the legs is yellow. The ventral part of the epinotum, pedicel and gaster are reddish yellow. The gaster is very smooth and shiny.

Type locality: Bella Vista, Peru.

Described from 6 workers labelled Cotype No. 72, Haskins Collection. One pin has been deposited in the Museum of Comparative Zoology, and was labelled Cotype 26811.

*Pseudomyrma crenulata* sp. nov.

## Worker.

Described from specimens labelled erroneously *P. kuenckeli* in the Harvard Collection.

Length 5-5.5 mm. Head as broad as long, markedly narrowed in front, with convex sides, well rounded posterior corners and straight occipital edge. The eyes are less than half the length of the sides of the head and very convex. Mandibles powerful and coarsely rugose; clypeal lobe very short, broad and rectangular. Antennal scapes reaching beyond the middle of the eyes but do not attain the occipital border. The whole head finely shagreened-punctate and shiny. Prothorax as broad as long in the midline, sharply bordered with the border crenulate (this is the first *Pseudomyrma* we have seen which has this character). Mesothoracic disc semicircular in front, concave behind; weakly elevated. Epinotal declivity broadest behind; petiole node trapezoidal, twice as broad as long. Postpetiole broader than long, with blunt corners at the sides. Thorax in profile weakly convex above, the epinotal declivity almost vertical. Petiole in profile similar to that of *P. maligna*, but shorter, with a nearly vertical posterior face and weakly crenulated lamina. Gaster very stout.

The color is uniformly testaceous yellow, infuscated at the vertex and middle femora. The pilosity is abundant, long and erect. The pubescence is long and untidy giving the ant an unkempt appearance.

Type locality. Guernavaca, Mexico.

Holotype No 76, Haskins Collection; 3 paratypes

The new species is related to the triplaridis-maligna group but differs from the related species by a series of unusual characters such as the broad node, the head narrowed in front, the crenulated epinotal margin.

#### GROUP *gracilis*

Of all the descriptions of forms which undoubtedly belong to the *gracilis* group 15 are good enough to permit the student to recognize the form, although even here some descriptions are not adequate to decide between two or more. The *gracilis* group shows in miniature the weaknesses of the whole genus *Pseudomyrma*, namely a planless accumulation of bad descriptions. Nobody really knows how many forms of *gracilis* have actually been described, because many of F. Smith's undecipherable descriptions may refer to *gracilis*.

The confusion arose because an entirely useless character (as far as this species is concerned) has been chosen as the chief diagnostic character, that is the color pattern. A casual collector, who picks up a specimen here and there and does not pay much attention to the structural features, will come to the conclusion that *gracilis* is a large group containing many dozens of good species; the color patterns are very striking indeed. They are however practically worthless, because even individuals from the same nest show marked differences. Several of the forms which are now recognized as subspecies or varieties in good standing exhibit the larger part of the variation range of the type series. This is shown in the diagram (Pl. IV, Fig. 26-30).

All forms of *gracilis* have at least part of the body black or dark brown; on the other hand there is no form which is completely black. The original type *gracilis* (Fabr.) has only the mandibles and the petiolar peduncle light colored; the other extreme is found in some specimens from the Amazon Valley, which have only the head black and the rest of the body yellow.

The fallacy of basing species, subspecies or varieties of *gra-*

*cilis* on color alone, has been recognized early. Emery (1890) after studying a large series came to the conclusion that *P. gracilis* (Fabr.), *P. bicolor* (Guérin), and the variety *dimidiata* Roger were identical. Emery proposed *P. bicolor* as the type of the species. Forel later made *P. ternitaria* Sm. a synonym of the type. It differs from the type by its smaller stature, but falls without question into the size range of the type series.

But even if other characters had been chosen to separate the forms of *gracilis*, its classification would still be very difficult. We have attempted to do this in our key, but have not been very successful. For instance *P. maculata* Smith (now subsp. *maculata*) is said to differ from the type by its shorter peduncle. We have studied a large series of specimens covering the whole area from Texas to Southern Brazil and Peru; all we can say is that the South American forms usually have longer and more slender pedicels, but even the type series includes forms with long and short peduncles, and intermediate forms are very common.

Every other character which might be chosen to effect a separation shows similar gradations. The elevation of the mesonotal disc, used by some writers shows all grades of development not only in the type series but in the series of *mexicana*, *agilis* and *sericea* as well.

The only reason we retain most of the names and even add to them is that the names sometimes are associated with the extreme development of some given character, and that certain color and structure patterns are characteristic of given regions.

*Pseudomyrma gracilis* var. *peruviana* var. nov.

Worker.

Length 8.5-9 mm. Identical with the variety *longinoda* from the same general locality. It differs from the latter by coloration, having the mandibles, clypeus, pedicel and gaster pale yellow; funiculi, coxæ and femora reddish brown to brownish yellow; rest of the legs and the scapes testaceous; head and thorax black. We have seen a similar color pattern in some specimens of the subsp. *agilis*, from which the new variety differs by the very pronounced shoulders. From the variety *longinoda*, its closest relative, it differs by its very abundant, long erect hairs on the occiput and thorax, and the opaque gaster (shiny in *longinoda*).

Type locality: Lima, Peru.

It is not unlikely that further collections in Peru will unearth numerous intergrades between the two new varieties.

Holotype No. 89, Haskins Collection.

*Pseudomyrma gracilis* var. *longinoda* var. nov.

Worker

Length 8–8.5 mm. Color black, except for the mandibles, clypeus, peduncle of the petiole, which are yellow or reddish yellow, antennæ, tibiae and tarsi brownish red. The coloration conforms to the description of the type *P. gracilis* (Faber, not Emery) Head opaque, rest of the body subopaque (as in *P. bicolor*). Postpetiole much longer than broad, piriform, as in *dimitiata* (more nodiform in *bicolor*, *sericata mexicana*). The peduncle is very long and has a secondary swelling at the location of the spiracles (this feature is much less developed in all other forms). Pronotum powerfully marginate with large overhanging shoulders, much more pronounced than in *agilis*. The clypeal lobe is very broad and nearly rectangular, as in some forms of the type series.

Type locality: Bella Vista, Peru. From fallen leaves.

We name this new form because it shows two characters in extreme development: the length of the petiolar peduncle and the margination of the thorax. It is nearest to *agilis*, from which it differs by a very much higher mesonotal disc, as well as by accentuation of some of the distinctive characters of *agilis*.

Cotype No. 90, Haskins Collection; one pin has been deposited in the Museum of Comparative Zoölogy, where it has been labelled Cotype 26812.

*Pseudomyrma kuenckeli* var. *hondurana* var. nov.

Worker.

Differing from the type in color pattern. Head reddish brown, darker than in the type; thorax dark reddish; gaster brown; front of the head and mandibles yellow.

The varieties of the species *kuenckeli* are separated mainly by their color pattern. We have not enough material on hand to make any positive statements as to whether color differences can be regarded as a good character for the separation of named varieties.

Type locality: Honduras (Bates coll.). Other specimens of this variety in the Haskins Collection are from Guatemala.

Described from 6 workers in the Museum of Comparative Zoölogy, labelled Cotype 26814.

*Pseudomyrma laevigata* subsp. *insularis* subsp. nov.

Worker.

Length 6.5–7 mm. Differs from the type by smaller size (type 8.5 mm.), character of the pilosity (long and black in the type, more sparse, shorter, and of golden color in the new subspecies); the shape of the prothorax (broad and flat above in the type, narrow and slightly curved in *insularis*), the coloration (bright yellow in the type, reddish yellow in the subspecies). The differences between the new subspecies and the remaining forms of *P. laevigata* are given in the key

Type locality: Barro Colorado Island, Panama.

Holotype No. 81, Haskins Collection.

*Pseudomyrma latinoda* var. *coronata* var. nov.

Worker.

Length 5.5–6 mm. Cotype 20542, Harvard Collection, 19 specimens. Tarsi and head testaceous-yellow. On the vertex a brown spot of variable shape and size; rest of the body dark brown. Head a little longer than broad, with very convex sides and slightly concave posterior border. The eyes are in the middle, very flat, and occupy less than half the sides of the head.

Mandibles heavily striated, with two large apical and three smaller teeth. Clypeus with a short, broad, straight lobe. Funiculi reach the middle of the head. Head very shiny, with abundant small foveoli. Prothorax broader than its length in the midline, submarginate on the sides. Mesothorax broader than long, with blunt angle on the sides. Epinotum longer than broad, very convex transversely. Petiole with a trapezoidal node, which is broader behind than long. Postpetiole bell shaped, much broader than long. In profile the pro- and meso-thorax form a convex line above, which is separated by a deep depression from the very convex epinotum. The node in profile longer than high, subtriangular, with rounded summit.

The whole body shiny; thorax and petiole finely punctate, postpetiole and gaster smooth; with relatively abundant erect hairs especially on the pedicel and moderately abundant pubescence, more dense on the thorax and gaster. The coxæ and femora are infuscated.

Type locality: Mouth of Jerume, British Guiana.

*Pseudomyrma sabanica* var. *saffoidi* var. nov.

## Worker.

Length 3.4–4 mm. Head slightly longer than broad, with convex sides and excavated posterior edge. The mandibles are microscopically punctate and shiny; clypeal lobe as in *P. belti*. The eyes are flatter than in the latter and the head is much denser punctate. The prothorax is sharply marginate on the sides. The mesonotal disc is longer than broad, with a straight posterior border. The epinotum is length-oval, broadest at the level of the stigmata. The petiole from above is fully twice as long as broad, and somewhat triangular, with a rather long and broad peduncle. The thorax is evenly convex in profile, but with a saddle shaped impression between meso- and epinotum. The petiole is shaped as in *belti bequarti* in profile, but longer.

Erect hairs very sparse on the body, but the pubescence is more abundant, very fine, white and adpressed. The whole body, except the head lucid. Color brown and uniform, not bicolored.

Type locality: Yerba Santa, Chiapas (N. C. Collins).

The new subspecies is close to *P. sabanica* from which it differs by its lighter brown color and other points.

Cotype 20437, Harvard Collection, 20 specimens.

*Pseudomyrma santschii* sp. nov.

## Worker.

Head almost as broad as long, narrowed behind, with slightly convex sides, almost completely taken up by the very large eyes; slightly excised behind. Mandibles with two large apical and several smaller teeth, all black; heavily striated. Clypeal lobe rectangular with straight anterior border. Head above with very fine punctation and fine pubescence, opaque; yellow with a dark brown spot around the ocelli. Thorax sharply marginate, deeply impressed between meso- and epinotum. With very fine long hairs and abundant and very fine pubescence. Pedicel from above similar to that of *P. gracilis*. Postpetiole and gaster slender with abundant pubescence. Thorax and legs brown except for yellow patches especially on the sutures and articulations of the legs; pedicel and gaster yellow. The dorsal part of the gaster is covered with many small sharply circumscribed brown spots, having the appearance of freckles. This is a very characteristic feature and distinguishes this ant from all other known *Pseudomyrma*. Size 8–9 mm.



Type locality: Lima, Peru

The new species is closely related to *P. gracilis* with which it has many features in common. All members of the *gracilis* group however have at least a part of the body black or very dark brown, while in the new form the dominant color is reddish brown. The freckled abdomen sets the new species aside from the numerous other forms related to *P. gracilis*.

Holotype No. 80, Haskins Collection; 3 Paratypes.

*Pseudomyrma sericea* var. *acaciorum* var. nov.

Worker.

Length 3.5-3.8 mm. Smaller than the other described form of *sericea* except the variety *vineni* Forel. Color chocolate brown, with the anterior part of the head, scapes and tarsi yellow, the funiculi, tibiae and sides of the prothorax brownish yellow. The clypeal lobe is rounded-triangular as in the variety *cordiae*. The base of the epinotum forms a square with rounded corners, and is shorter than the declivity. The fine hairs on the pronotal angle, and on the nodal angle (one on each side) are as in the other *sericea* and seem to be characteristic of the species.

Type locality. Tumba Muerto Road, Canal Zone. Living in *Acacia spadicigera*.

The new variety differs from all others by its color pattern, structure of the epinotum and pedicel in profile.

Described from a specimen labelled cotype 22865, in the Harvard Collection, 21 specimens.

*Pseudomyrma sericea* var. *lisa* var. nov.

Worker.

The new variety agrees very closely in stature and even in coloration with *P. sericea* var. *acaciorum* which lives on *Acacia spadicigera*.

It differs from the latter by its slightly smaller size and color pattern. *P. lisa* has a beautiful color, deep lustrous brown and golden yellow. The yellow portions are: mandibles, clypeus, cheeks, antennae, pronotum, legs and pedicel; the pronotum has two small dorsal spots; other light brown spots or areas are on the sides of the prothorax, upper coxae, central part of the femora and a small triangle on the petiole, between the characteristic backward directed spines. The deep brown areas are bordered with yellow on the mesonotum and on the declivity of the epinotum.

*P. sericca* var. *lisa* is probably only a local variety of *acaci-orum*. The sides of the thorax are smooth in *lisa* (punctate in *acaci-orum*).

Type locality: Peru.

Holotype No. 78, Haskins Collection.

*Pseudomyrma spinolæ* var. *infernalis* var. nov.

Worker.

Length 4.5 mm. Larger than the var. *convarians*. Color brownish yellow, with the gaster a little darker, barely missing being bicolored. The type is more reddish, as is the var. *gaigei*. Mandibles pale yellow with five strong teeth. Head finely punctate and opaque. Prothorax evenly rounded, not marginate, as broad as long in the midline. The node from above is subtriangular, approaching trapezoidal shape.

Female.

Length 5-5.5 mm. Head and pedicel very much longer than in the worker. The thorax, except prothorax, brown, as the gaster. The latter opaque (shiny in the worker)

Male

Length 5 mm. Much darker than the other castes, with a very long and slender pedicel.

Type locality: Red Tank, Canal Zone. Taken from an *Acacia spadicigera*. Other specimens were taken by Prof. Banks at Cambia, Canal Zone. The latter are more slender, with more reddish color and they approach the type in the weaker margination of the prothorax.

The new variety differs from the type by lack of margination on the prothorax; from *convarians* by larger size; from *gaigei* by the narrower postpetiole and from *atrox* by the non-notched clypeal lobe.

Gynotype No. 100, Haskins Collection. Androtype No. 100A, Haskins Collection.

Described from cotype 20547, Harvard Collection, many workers.

*Pseudomyrma spinolæ* var. *sclerosa* var. nov.

Worker.

Length 4 mm. Differs from all other forms of the *spinolæ* group by lacking all traces of bicolouration. The body is uniformly bright reddish yellow with the mandibles barely lighter colored. The whole body is opaque. The clypeal lobe is straight

as in the variety *infernalis*. The prothorax lacks all traces of margination. The mesonotal disc is conspicuously elevated.

Type locality: Granada, Nicaragua. (Baker Coll.).

The new variety is closest to the variety *infernalis* from which it differs by the coloration, elevated mesonotal disc and the more pronounced sculpture.

Cotype No. 101, 3 workers in the Haskins Collection.

Described from specimens marked cotype 23145, in the Harvard Collection.

***Pseudomyrma tenuis* var. *andina* var. nov.**

Worker.

Length 5 mm. Identical with the type except for the coloration, which is reddish yellow as in the variety *paraensis*. The node is spined as in the type but the margins are sharper and the spines longer. The sculpture on the thorax is much coarser than in the type and consists of coarse punctures (fine punctation in the type). The head is a little broader in the new variety.

Type locality: Lima, Peru. From an unnamed tree.

Cotype No. 69, Haskins Collection; one pin has been deposited in the Museum of Comparative Zoology and is labelled Cotype 26814.

***Pseudomyrma tenuis* var. *guatemalensis* var. nov.**

Worker.

Length 6 mm. Color reddish yellow with the head brownish yellow. More robust than the type; both the pro- and mesothorax broader than long; node without either angles or spines behind, which distinguishes this variety from all others; the margin of the node is sharply raised and is brownish, contrasting sharply with the bright yellow color of the sunken portion of the node from above.

Type locality: Esquintla, Guatemala.

Cotype No. 70, Haskins Collection.

***Pseudomyrma triplaridis* Forel.**

1904, Zool. Jb. Syst., 20, 684, all castes.

Worker.

Redescribed for the purpose of illustrating characters which can be used in separating the newly described subspecies. Length 4.5–4.8 mm. Head  $1\frac{1}{3}$  times as long as broad, with

nearly straight sides and weakly concave posterior border. The eyes are more than  $1/3$  but less than  $1/2$  the length of the sides of the head. The mandibles are striate and not lighter colored than the rest of the head. Clypeal lobe straight in front. The scapes are short and thick and fail to reach the middle of the eyes. Antennal joints 3-7 very transverse. Head strongly punctate and opaque. The prothorax is considerably longer than broad and submarginate. The disc not semicircular in front but with a rounded angle; it is semicircular behind and separated from the epinotal base by a wide margin. The latter is suboblong of the same width most of its length, concave in front. The petiolar node is subhexagonal with rounded corners. The postpetiole is broader than long and nodiform. The gaster is slender, with subparallel sides. In profile the thorax is weakly concave above with a strong depression at the mesepinotal suture. The convex epinotal base is rounded into the short declivity.

Head opaque, rest of the body subopaque. The pilosity is abundant, erect and of golden color. The pubescence is short and untidy; longer and more regular on the gaster, giving the latter a silky appearance.

Habitat: The specimens from which the description was made were collected by N. A. Weber in Venezuela, at the mouth of the Orinoco. The identification was made by Weber. The type locality is Amazonas.

*Pseudomyrma triplaridis* subsp. *biolleyi* subsp. nov.

Worker.

Length 4.8-5.2 mm. Head barely longer than broad, with convex sides, well rounded occipital corners and concave occipital edge. The eyes are smaller than in the type, about  $1/3$  the size of the head, and flat. The mandibles are not paler than the head. (As in the type). The clypeal lobe is longer, and a little convex in front. The antennæ are similar to those of the type. Head finely punctate and very shiny. Prothorax broader than its length in the midline, evenly convex and very smooth. Disc semicircular in front (angular in the type). The epinotal base is longer than broad, broadest at the level of the stigmata, the part in front of that level is subtrapezoidal; the part behind that level gradually narrows towards the junction with the base. The petiolar node is globular above (as in some *arboris-sanctæ*

forms) and the pedicel is as broad as in *latinoda*. Postpetiole and gaster similar to the type. In profile the thorax is strongly impressed at the mesepinotal suture, the base and declivity are of the same length and form a blunt angle. The petiole has a strong antro-ventral tooth and a lamella. Pilosity and pubescence much less than in the type. The new variety is distinctly bicolored. The head is dark reddish brown, the gaster brown, except for the first segment which is reddish or reddish yellow, as is the rest of the body. The mesonotal disc is brownish.

Type locality: Kartabo, British Guiana (Wheeler Coll.).

Cotypes: No. 20648, Museum Comp Zool.

*Pseudomyrma triplaris* subsp. *boxi* subsp. nov.

Worker.

Length 4 mm. Head  $1\frac{1}{4}$  times as long as broad, with convex sides, well rounded posterior corners and concave occipital edge. The mandibles are not darker than the rest of the head, which is characteristic of all forms of *P. triplaris*. The clypeal lobe is long, narrow and straight in front. Head strongly punctate and opaque. The scapes reach the middle of the eyes, which are slightly larger than  $\frac{1}{3}$  the sides of the head. Prothorax as long as broad, well rounded, not marginate, strongly foveolate. The anterior rim of the mesonotal disc is semicircular. Epinotum longer than broad, broader at the level of the stigmata, strongly sculptured. Petiolar node shaped as in the subspecies *biolleyi*, with a very broad peduncle. Postpetiole and gaster stout, more convex and more robust than in the type.

Pilosity and pubescence abundant, but less than in the type. Color brownish yellow, antennæ, gaster and tibiae a shade lighter.

Type locality: Blairmont, Berbice, British Guiana (H. E. Box coll.).

The new subspecies differs from the type and the *ss biolleyi* by its strong sculpture, different color and other characters.

Described from cotype 23146, Harvard University Collection, many workers.

*Pseudomyrma triplaris* subsp. *trigona* subsp. nov.

Worker.

Length 4–4.8 mm. Head subrectangular.  $1\frac{1}{3}$  times as long as broad, with weakly convex sides and relatively sharp occipi-

tal corners. The clypeal lobe is short and narrow and has a convex anterior border. Scapes short, not attaining the middle of the eyes, which are a little more than  $1/3$  the sides of the head and long and flat. Head densely punctate and subopaque. Prothorax longer than broad, distinctly margined at the sides, mesonotal disc angular in front as in the type. Epinotum ovoid and convex. Petiolar node subhexagonal. Postpetiole broader than long. The gaster is shaped as in the type. Petiole in profile with a strong antero-ventral tooth; the lamina below not crenulated.

Pilosity and pubescence considerably less than in the type. The color is uniformly red; in the immature specimens reddish yellow.

Type locality. Blairmont, Berdice, British Guiana (Box Coll.).

The differences between the new subspecies and the others are given in the key.

Described from type 23147, Harvard University Collection.

*Pseudomyrma voytowskii* sp. nov.

Worker.

Head longer than broad, with parallel sides, the eyes occupying more than half the length of the sides. Mandibles white, smooth, with two larger apical teeth and some smaller ones. Scapes slender and short, not quite reaching the middle of the eyes. The whole head smooth, shiny and yellow except for a region on the occiput, which appears brownish; this is caused by the fact that the integument is transparent like a window, revealing the insides of the head. Prothorax not marginate, smooth and yellow. The mesonotal disc is a rounded triangle. Mesothorax and epinotum dark reddish brown, smooth, shiny on top, with heavy punctation on the sides. Pelicel in profile shaped as in *tenuissima*, with the anterior and posterior faces of equal slope; heavily punctate and devoid of ventral carina and ventral tooth. Postpetiole nodular in profile, with less coarse sculpture. Gaster stubby, smooth and very shiny. Petiole from above shaped as in *subtillissima*, subtriangular and very shiny.

Color. Distinctly bicolored, with the anterior part of the head and the prothorax yellow. The rest of the body dark brown, appendages lighter brown. Pilosity nearly absent, hav-

ing but three to four long hairs on the gaster, and with the pubescence so short and sparse that only careful observation reveals its presence in a few spots. Size 2.2 mm, including the mandibles.

Type locality: Lima, Peru.

The new species is related to *P. subtilissima*. It differs from *tenuissima* by the broader head and thorax, from the type by the almost complete absence of hairs, and from the var. *andina* by sculpture and other characters.

Holotype No. 77, Haskins Collection

*Pseudomyrma voytowskii* var. *costaricensis* var. nov.

Worker.

Larger than the type; length 4.2 mm. Of the same general appearance as *P. voytowskii* and with a similar color pattern. The head is very dark reddish brown, with the mandibles, clypeus and antennæ yellow. The scapes are browned in the middle. The head is subopaque (shiny in the type). The pilosity is more abundant in the type.

Type locality: San Jose, Costa Rica (Wheeler Coll.).

Holotype No. 87, Haskins Collection.

*Pseudomyrma weberi* sp. nov.

Worker.

Described from specimens in the Harvard Collection, erroneously labelled "subsp. of *P. caroli*."

The new species belongs to the branch Apedunculata which has a short petiole; it is near *P. allidora* and *P. acanthobia*. Length 3.8–4 mm. Weakly bicolored. Head dark reddish brown; mandibles, clypeus and antennæ yellow brown. Head subrectangular, 1 1/3 times as long as broad, with slightly convex sides and convex posterior border. Eyes occupying less than half the sides of the head. Clypeal lobe narrow, relatively long and concave in front. Scapes reaching the middle of the head. Head finely punctate and a little shiny (*P. acanthobia* has the head very concave behind and shiny; *P. allidora* has the head much longer, concave behind and very opaque). Prothorax longer than broad and not marginate (broader than long in *acanthobia*). The mesonotal disc is angulate in front (rounded in *acanthobia*, angulate in *allidora*). The epinotum is shaped as in *allidora* and is narrower behind; the anterior edge is straight (angulate in *acanthobia*, semicircular in *allidora*).

The new species is readily separated from the more closely related species by the shape of the petiole in profile; *weberi* is the only species that has the posterior face of the peduncle concave; the antero-ventral tooth is very small and bears a single long hair.

Type locality: Esquintla, Guatemala.

Cotype 26815, Museum Comp. Zool., No 88, Haskins Collection.

*Pseudomyrma wessoni* sp. nov.

Worker.

Length 3.5–4 mm. Head  $1\frac{1}{4}$  longer than broad with weakly convex sides and straight posterior border. The eyes occupy more than  $\frac{2}{3}$  the sides of the head. Mandibles pale yellow, longitudinally striated and opaque. Clypeal lobe with convex anterior border. Antennal scapes reach the middle of the eyes. Antennae pale yellow, head darker yellow, very heavily punctate and opaque. Prothorax much longer than broad; margined and convex above. Mesothoracic disc convex. Epinotal base longer than broad, broadest at the level of the stigmata. Petiole from above triangular, with convex posterior edge, sharply margined. Postpetiole broader than long. Thorax in profile with very deep and broad mesepinotal depression; epinotal base much higher than the prothorax, convex, with a sharp angle at the declivity. Petiole in profile subtriangular, differing from all other species of the subgenus *Apedunculata* by its vertical posterior face. *P. allidora* has a similar petiole but the antero ventral tooth is blunt in the latter species, not sharp as in *wessoni*.

Color almost uniformly reddish yellow, with the tibiae lighter. Pilosity short and sparse; pubescence relatively abundant, fine, silky and adpressed. Pedicel and gaster shiny, the rest opaque.

Type locality: Lima, Peru.

The new species is related to *P. subtilissima*, *sericea*, *allidora*, *acanthobia* and *colei*. It differs from each of these by the shape of the pedicel in profile, which is very short, with a vertical posterior face and a sharply recurved antero ventral tooth.

Female.

The female is of nearly the same size as the worker and with the same characters, except for the cast differences. There is a tendency to darker coloration; more brownish red, with an indication of bicoloration (the prothorax lighter brown than the rest of the thorax).



Cotype No. 26816, Museum Comp. Zool., Gynotype No. 74, Haskins Collection

*Pseudomyrma wessoni* var. *tuberculata* var. nov.

Worker.

Head about as broad as long with very large eyes, occupying more than half of the convex sides. Mandibles with two large apical teeth and several smaller ones, all brown, heavily striated; the clypeus with a sinusoid anterior border. Head and antennal scapes densely punctate and opaque. Prothorax marginate, deeply impressed mesepinotal suture and the epinotum with a faint indication of epinotal spines on the junction of the epinotal base and declivity. (This is a very unusual feature in workers of *Pseudomyrma*). Petiole in profile similar to that of *wessoni*, but shorter. Postpetiole very short and much broader than long. Abdomen stubby.

Coloration uniformly dark yellow or light brown. The pilosity consists of sparse long hairs. The pubescence is very fine and somewhat more abundant on the head and gaster.

Type locality: Lima, Peru.

The new variety is related to *P. wessoni* from which it differs by the structure of the pedicel, the small epinotal tubercles and the darker coloration. The sculpture is much as in the type.

Holotype No. 82, Haskins Collection

*Pseudomyrma wheeleri* sp. nov.

Female.

Head almost twice as long as broad, with straight sides and the eyes occupying a little more than the middle third of the sides. Mandibles with two large apical teeth, a diastemma and two small basal teeth; heavily rugose, with stiff erect hairs. Clypeus with a rounded lobe. Scapes thickened, reaching a little beyond the anterior edges of the eyes. Whole head opaque, with dense punctation. Borders of clypeus and mandibles black. Thorax with fine punctation, opaque, with sparse long hair and medium dense pubescence. Petiole in profile about twice as long as high, without a peduncle, but with a short central carina which ends in a blunt tooth anteriorly; from above clavate in outline, with long stiff hairs. Heavily punctate and opaque. Wings sooty and with dense fine hairs. Gaster long and slender, with very fine punctation, a little shiny, with a few erect hairs

and somewhat more abundant pubescence. Head, sides of the pronotum and all articulations, yellow. Rest of the body reddish brown. Length 8 mm.

Type locality. Peru.

Male.

Head very short; eyes occupying the whole sides of the head. Mandibles short, finely striated, with a large apical and a few small basal teeth; with sparse and very long hairs. Clypeus with a projecting, circular lobe, prolonged backward between the antennal insertions. Frontal carinae absent. Scapes so short that they form but elongate beads. Funiculi ten-jointed, with all joints of equal length and thickness. Occiput slightly sinusoid. Whole head densely punctate and opaque, bright yellow from the mandibles to the level of the antennal insertions, dark brown further back. Thorax of the usual shape; Mayrian furrow distinct, wings yellow and very hairy; very finely sculptured leaving the integument shiny; light brown, with all sutures yellow, petiole and postpetiole extraordinarily slender, the petiole thinned to a very slender stalk, with a slight swelling in the posterior third; with sparse long hairs and dense, coarse pubescence. Gaster very slender with dense pubescence. The petiole is unarmed below.

Bicolored, with part of the head dark brown, thorax lighter brown, the color gradually becoming lighter backward, gaster dark yellow.

Gynotype No. 79A, Androtype No. 79B, both in the Haskins Collection.

## EXPLANATION OF PLATES

## PLATE II

Showing the petioles from above of a representative series of *Pseudomyrma*

- |                                       |                           |
|---------------------------------------|---------------------------|
| 1 <i>excavata</i>                     | 13 <i>deceptionis</i>     |
| 2 <i>tenuis</i>                       | 14 <i>filiformis</i>      |
| 3 <i>nigropilosa</i>                  | 15 <i>oculata</i>         |
| 4 <i>gracilis</i>                     | 16 <i>sericea</i>         |
| 5 <i>denticollis</i>                  | 17 <i>belle bequaerti</i> |
| 6 <i>sabannica</i>                    | 18 <i>canescens</i>       |
| 7 <i>elegans</i>                      | 19 <i>arboris-sanctæ</i>  |
| 8 <i>champium</i>                     | 20 <i>bradleyi</i>        |
| 9 <i>dolichopsis</i>                  | 21 <i>caroli</i>          |
| 10 <i>kuenckeli</i>                   | 22 <i>circularata</i>     |
| 11 <i>acanthobia</i>                  |                           |
| 12 <i>brunnea</i> var. <i>virgata</i> |                           |

## PLATE III

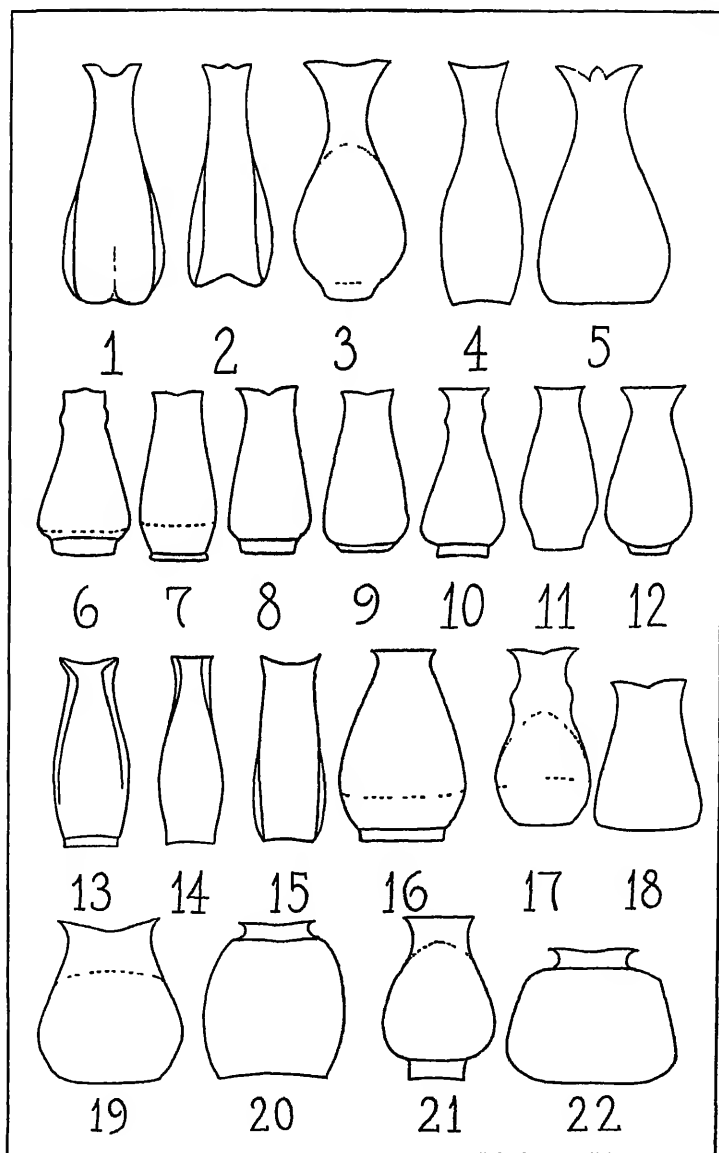
Petioles in profile of a representative series of forms of *Pseudomyrma*.

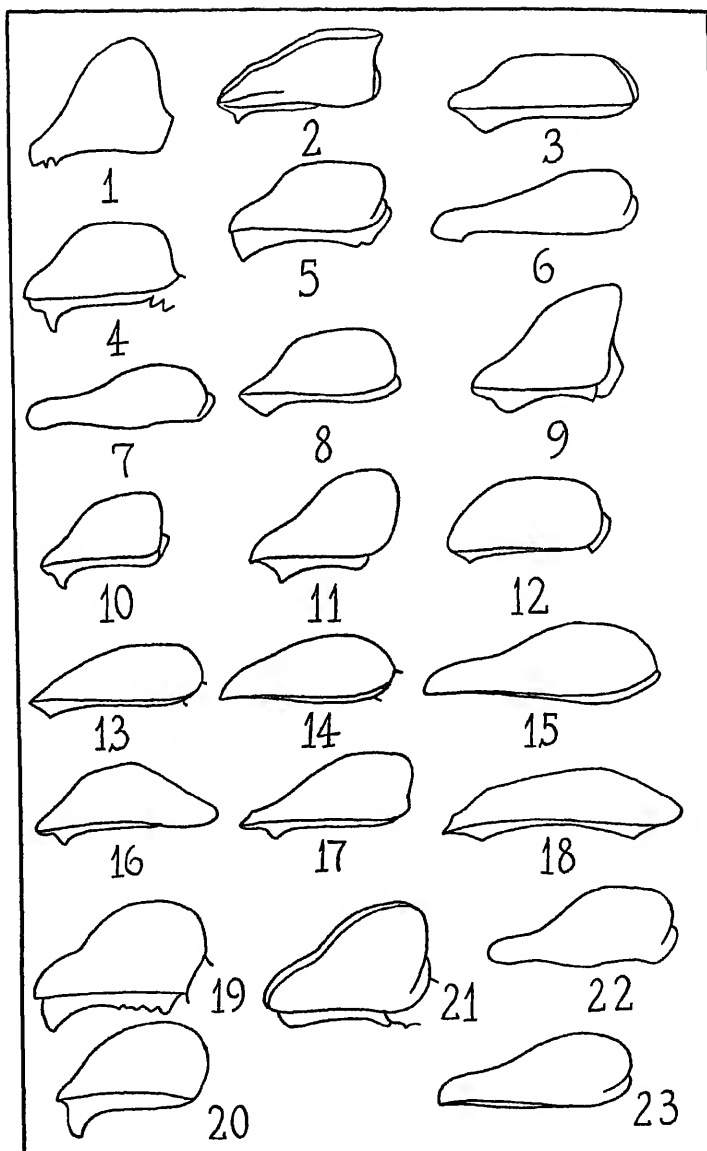
- |                             |                                |
|-----------------------------|--------------------------------|
| 1 <i>excavata</i>           | 13 <i>acanthobia delcudata</i> |
| 2 <i>tenuis</i>             | 14 <i>nigromicta</i>           |
| 3 <i>tenuissimum</i>        | 15 <i>flavulula</i>            |
| 4 <i>champium</i>           | 16 <i>weberi</i>               |
| 5 <i>denticollis</i>        | 17 <i>colei</i>                |
| 6 <i>sabannica</i>          | 18 <i>filiformis</i>           |
| 7 <i>spumicola</i>          | 19 <i>latimoda</i>             |
| 8 <i>dolichopsis</i>        | 20 <i>arboris-sanctæ</i>       |
| 9 <i>sericea acaciornum</i> | 21 <i>picta humboldti</i>      |
| 10 <i>weissoni</i>          | 22 <i>canescens</i>            |
| 11 <i>sericea</i> type      | 23 <i>belle</i>                |
| 12 <i>elongata</i>          |                                |

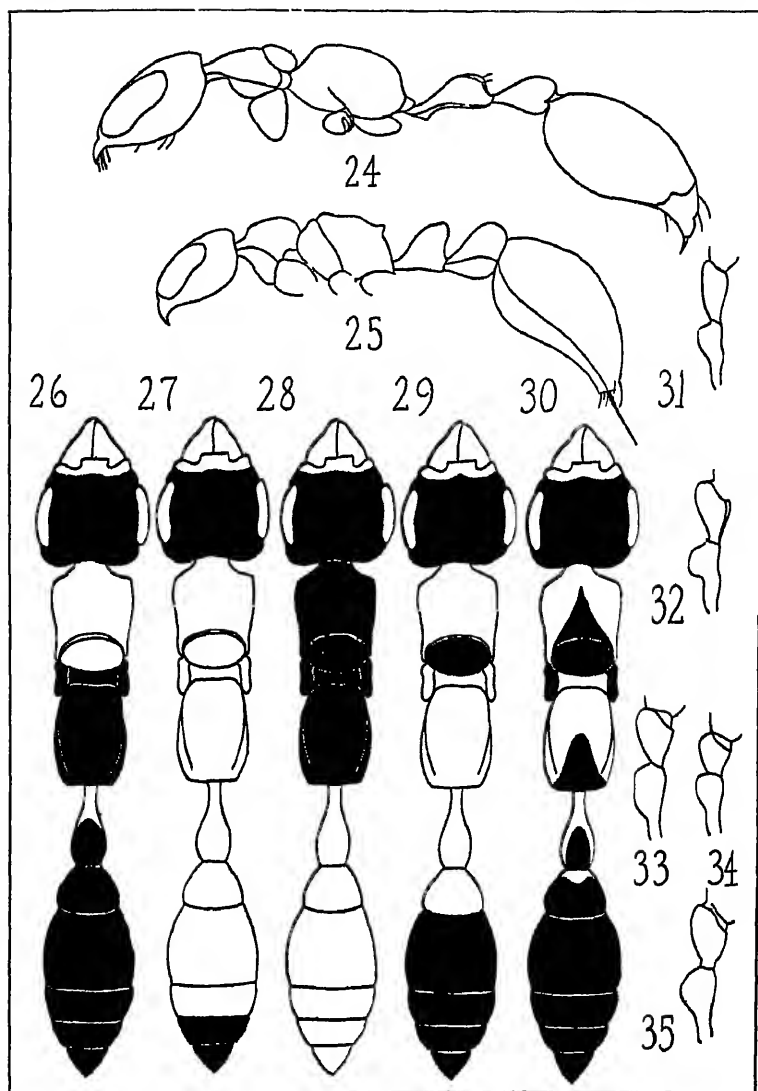
## PLATE IV

Color patterns in *Pseudomyrma gracilis* (figs. 26-30), pedicels in profile (figs. 31-35); outline drawings of two newly described forms (figs. 24, 25).

- 24 *acanthobia delcudata* var. *lunai*
- 25 *versum* var. *tuberculata*
- 26 *gracilis* subsp. *sericata*
- 27 *gracilis* subsp. *carapinum*
- 28 *gracilis* var. *peruviana*
- 29 *gracilis* subsp. *mexicana*
- 30 *gracilis* var. *dimidiata*
- 31 *gracilis* var. *peruviana*
- 32 *gracilis* var. *squamifera*
- 33 *gracilis* var. *mexicana*
- 34 *gracilis* var. *maculata*
- 35 *gracilis* type







NOTES ON THE MORPHOLOGY OF THE  
GENUS LYCÆIDES(LYCÆNIDÆ, LEPIDOPTERA)<sup>1</sup>

By V. NABOKOV

Out of the hundred or so holarctic *Lycænids* distributed among at least sixteen genera of the subfamily *Plebejinæ* (definitely fixed by Stempffer, 1937, Bull. soc. ent. France 42 :211, etc.; *not* covering the superficial concept of "Blues" for which no systematic term or division can exist), only fourteen species or so, two of which are obvious invaders from the Tropics, occur in the nearctic region (north of the 30th parallel). These belong to seven genera, four of which (the first four in the list given below) are holarctic and contain together six species of which one half is common to both regions. All three exclusively American genera have the free portion of the ædæagus elongated; all the exclusively palearctic genera, except *Aricia* R. L. (and the, mainly tropical, *Chilades* Moore<sup>2</sup> and *Freyeria* Courvoisier) have stubby or proximally "bulbous" free portions. Of the four genera common to both regions one half belongs to the first type and one half to the second.

The only *Plebejinæ*, so far known to exist in the nearctic region, are: 1. *Agriades* Hübner: *glandon* Prunner (holarctic); 2. *Vacciniina* Tutt: *optulete* Knoch (holarctic); 3. *Lycæides* Hübner: *argyrognomon* Bergstrasser (holarctic), *scudderi* Edwards, *melissa* Edwards; 4. *Plebejus* Kluk: *serpiolus* Boisduval; 5. *Plebulina*, n.g. (remarkably amalgamating the *Plebejus* or *Lycæides* ædæagus with the valval *processus superior* and uncus + falces of *Albulina* Tutt): *emigdionis* Grinnell (genotype); 6. *Icaricia*, n.g. (allied to *Aricia* R.L. in ædæagus; somewhat to *Polyommatus* Latreille in general type of uncus as seen ventrally; close to both in *processus superior* of valve; distinguishable by the underdeveloped, i.e. devoid distally of any

<sup>1</sup> Published with the aid of a grant from the Museum of Comparative Zoology at Harvard College

<sup>2</sup> Unexpectedly represented by *speciosa* Staudinger in the Andes

semblance of hook, triangular, laminate, proximally very broad falx, its very gradually tapering apex hardly exceeding in height the level of its strongly humped humerulus)· *icarioides* Boisduval (genotype) with its various subspecies (clamoring for a reviser) and four other species, viz : *acmon* Doubleday-Hewitson, *sp. indet.* (? *chlorina* Skinner), *neurona* Skinner and *shasta* Edwards, these four structurally smaller than the genotype (with an uncus lobe distally somewhat grooved in lateral view but not actually revealing Stempffer's process as it occurs in *Aricia anteros* Freyer), and 7. *Hemiargus* Hübner: a curiously aberrant genus (somewhat allied to *Chilades* Moore) which is represented by *hanno* Stoll and in which I very provisionally retain *isola* Reakirt. An unexpected *futura superior* is present in the former and is monstrously developed in the latter

For some time I have been especially concerned with the genus *Lycæides*. In a preliminary paper (Nabokov, 1943 [March, 1944], *Psyche* 50 :87 etc.) an attempt was made to clear up several taxonomic points mainly in regard to the nearctic section; <sup>1</sup> the palæarctic one is still badly confused taxonomically, especially because the type specimens of a number of races have never been examined structurally (German authors, for instance, blindly relying upon the haphazard commercial identifications of the Staudinger firm). These matters I shall discuss elsewhere, but it is necessary to make a few comments regarding the genotype.

This is the "*argus* Linn." of Hübner ([1823], *Verz. bekannt. Schmett.* 5 :69), *nec* Linn., which was selected as the type by Scudder (1872, 4th Ann. Rep. Peabody Acad. Sci. 1871:54; 1875, *Proc. Amer. Acad. Arts Sci.*, Boston 10:208), and since Hübner's *argus* is the "*Argus*" of Reverdin (1917, *in* Oberthur, *Et. lép. comp.* 14:22, fig. 3, uncus) it follows that it is also the "*argyrognomon* Bergsträsser" of Tutt [and Chapman] (1909, *Brit. Butt.* 3:205-208, pl. 50, fig. 2, uncus) and thus not the "*Ligurica*" of Reverdin (1917, *op. cit.*:22, fig. 4, uncus) which is the "*ismenias* Meigen" of Heydemann (1931, *Int. ent. Zft.* 25:129) and the "*argyrognomon* Bergsträsser" of Forster (1938,

<sup>1</sup> With an incidental suggestion (*lc* 88, *nola*) that *cleobis* Bremer falls to *subsolanus* Eversmann I now find that Hemming (1938, *Proc. R. Ent. Soc. London*, 7 (1), B : 5-7, fig. male, type) had already come to the same conclusion



Mitt Munchner ent. ges 28:11), wrongly, and belatedly, selected by the latter author as "type" with the suggestion that readers look up for themselves Hubner's plate. They do, and find (Hubner, Samml. europ. Schmett. pl. 64 [1800]) that fig. 316, to which Scudder referred when selecting the type, can be easily matched by German males of the "*Argus*" of Reverdin and of the "*argyrognomon* Bergstr." of Tutt and, consequently, of Hemming (1934, Gen. names hol. butt. 1:108), who definitely fixed it (thus excluding the other species of *Lycwides* which he knew well) as the type of the genus, and this clinches the matter, whatever the two species be called. The publication of Beuret's important paper (1935, Lambillonea 35:162, etc.) has led to attempts to transfer the name *argyrognomon* Bergstrasser (1779, Nomenclatur, 2. 76-77, pl. 46, fig. 1,2) from the short-falx species (the genotype) to which it was applied by Tutt (1909) and which we shall term for the moment species X, to the long-falx species, *ismenias* Meigen, 1830 (Heydemann,<sup>1</sup> 1931) which we shall term species Y. These attempts have been prompted by the fact that female specimens apparently belonging to Y (Beuret, l.c., does not give the reasons for his determination), casually collected in the type locality of *argyrognomon* Bergstr., proved to be closer to Bergstrasser's equivocal figures than sympatric females of X. One cannot deny that the figures apply better to the general run of Y females than to the general run of X females, but pending further investigation, or some formal decision on the part of a special commission, I am compelled to use in this paper the name *argyrognomon* Bergstr. for X because of the following considerations: 1. As noted and illustrated by Beuret himself (1934, Lambillonea 34:119) at a time when he still called X by the name *argyrognomon*, absolute similarity to Bergstrasser's figures is exhibited by what he (inconsequently) named *argyrognomon rauraca* Beuret (l.c. pl. 5, 5a, fig. 9, 10. See also Beuret, 1928, Soc. Ent. 43, fig. 5, 10, uncus, *argyrognomon*, "Augst"). This, now extinct, colony was discovered on a plot of ground, a thousand feet long and 1/6 of this broad, near Augst in the Aargau, N. Switzerland, i.e., some 200 miles south from the type locality (Bruckköbel Forest, in the Hesse-Nassau district, Central Germany) of *argyrognomon* Bergstr.; but mor-

<sup>1</sup> Whose clumsy fixation I reluctantly adopt.

phologically, *i.e.*, apart from current geographic obsessions and notwithstanding the inconvenience of the thing not flying where it ought to fly, *rauraca* Beuret was when discovered, and in my opinion remains so now, an absolute synonym of *argyrognomon argyrognomon* Bergstr., since in genitalia it corresponds to Tutt's *argyrognomon* Bergstr. and in the appearance of the female to Bergstrasser's figures, 2. There is no guarantee that the next German, or British, collector in the Hesse-Nassau district will not come across chance specimens or a little colony of X, different from the race of X (*lycidusoides* Beuret, 1934), assigned to the general region, and similar to Beuret's Aargau series — in which case the whole question would have to be brought up again (Tutt remaining the first reviser<sup>5</sup>); and 3. It is not at all clear what name should be used for X if "*argyrognomon*" is switched to Y. The name *acracon* Fabricius (1787 Mantissa 2:76), on the basis of a worn specimen of *argus* auct (which combined at least X and Y) in the Banksian collection was assigned to the latter omnibus species by Butler (1869, Cat. Diurn. Lep., descr. by Fabricius, in coll. B.M.: 171) which leaves us none the wiser, even if Butler did see "the type female in Copenhagen" as stated by Heydemann (1931, Int. ent. Zft. 25:150) who anyway had not seen it himself and thus was perfectly unjustified in using the name (*l.c.* pl. 1, fig. 4, 12) for a race of X. The name *calliopsis* Boisduval ([1832] Ic. hist. lép. Europe 1:58, fig. 4,5) suggested by Hemming (1938, Proc. R. Ent. Soc. London 7,B:4) also cannot be used for X, until the female type (from Grenoble, France) and the Uriage male assigned to *calliopsis* by Oberthur (1896, Et. ent. 20, pl. 5, fig. 64) are critically investigated in the B. M. collection. In view of the fantastic misadventures which names have undergone in this genus, pedantic care must be taken, so as to avoid some new nomenclatorial trouble in the future.

The genus *Lycæides*, of which *argyrognomon* Bergstr.-Tutt is the type, is characterized by an uncus (including the falces) exceedingly different from the corresponding structure found in other subdivisions of the *Plebejinæ*, and as I think it advisable to base specific unities upon the intrageneric variation of that character which intergenerically is responsible for the greatest

<sup>5</sup> In the sense that by figuring the male genitalia he first applied the name *argyrognomon* Bergstr. (which previously to 1909 had covered at least two *Lycæides* species and a form of *Plebejus argus* Linn.) to a definite species

hiatus, it is the uncus that I have selected (partly in development of Reverdin's, Chapman's, and Stempffer's views) for differentiating species in the *Lycaenides*.

The male armature consists of a dorsal (in regard to the body) portion (the uncus) and of a ventral one (the valves — which have a constant fishlike shape in the *Plebejma*). The two are hinged to each other somewhat in the way of the lids of a shell and appear "closed" when viewed *in situ*. When teased out of the tissues and viewed ventrally, *i.e.*, when the whole organ is forced open oysterwise so that its symmetrically extended valves continue to point down, whereas the uncus lobes point distad from the observer, the most conspicuous thing about the upper portion is the presence of a pair of formidable semi-translucent hooks (the subunci or falces — of a peculiar shape not found in allied genera), produced from the opposite side of the distally twinned uncus and facing each other in the manner of the stolidly raised fists of two pugilists (of the old school) with the uncus hoods lending a Ku-Klux Klan touch to the picture. The flame-shaped distal part of the candle-shaped ædeagus reaches a point between their elbows, while its proximal part is propped by the *fullura inferior* (furca) at the root of the valves.

In the paper already referred to, I introduced the following terms: F. for the length of the upright portion, or *forearm*, of the falx measured from its distal point to the apex of its elbow; H. for the length of the *humerulus* of the falx, from the apex of its elbow to the apex of its shoulder; and U. for the length of the *uncus lobe* from its distal point to the apex of the shoulder of the falx. In the majority of some 500 preparations, regardless of whether the elbow of the falx happened to be raised (in the follow-through of an "uppercut," to pursue the pugilistic image) as it is for instance in fig. ARG.A. of pl. 1, or whether it remained in its normal position (*i.e.* with the forearm parallel to the axis of the uncus lobe), a rather curious fact was noticed, namely that the distance between the tip of the falx and the apex of the shoulder exactly equalled U. This suggested the tracing of a triangle, FHU, its lines joining three points: apex of forearm, apex of elbow, and apex of shoulder. A glance at fig. 1 will show that, according to the dimensions of forearm, humerulus and uncus lobe, this triangle assumes a different size (showing the gradual generic development) and a different shape (showing the specific relative dimensions of parts).

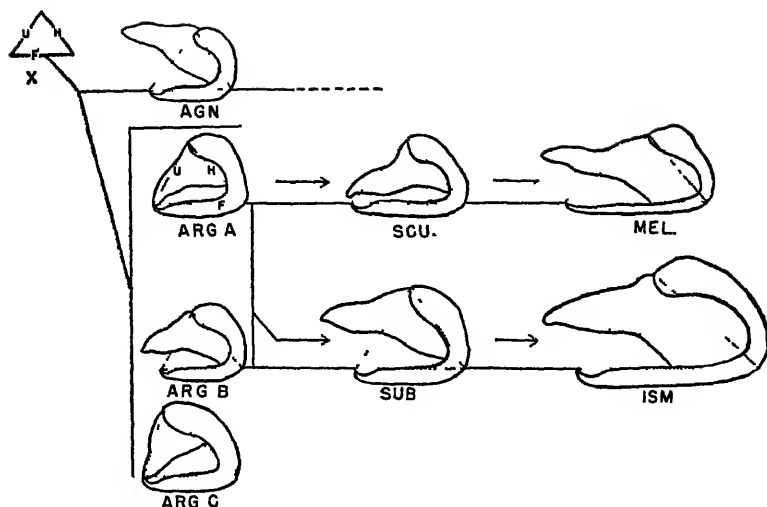


FIG 1 EVOLUTION AND SPECIATION OF UNCUS IN LYCÆIDES  
(All the figures are  $\times 33$ )

F — length of forearm of falx

H — length of humerus of falx

U — length of uncus lobe, equal to distance between apex of falx and apex of shoulder

FHU — triangle for measuring relative dimensions of parts

X — hypothetical ancestor,  $FHU = 0.25 + 0.22 + 0.22 = 0.69$  mm

AGN — *agnata agnata* Staudinger, prep 193, "Maralbaschi [Maralbashi, W. Sinkiang, Central Asia]" ex coll Weeks, M C Z,  $FHU = 0.33 + 0.26 + 0.30 = 0.89$  mm

ARG.A — *argyrognomon* Bergstrasser ssp (*ssp anna* Edw prov.), prep 348, "Brewster, Washington [N. America], 18-VII-1940" coll Stallings-Turner,  $FHU = 0.36 + 0.33 + 0.27 = 0.96$  mm

ARG.B — *argyrognomon bellieri* Oberthuz, prep 189, "Corsica [S. Europe]" ex coll Weeks, M C Z,  $FHU = 0.33 + 0.30 + 0.25 = 0.88$  mm

ARG.C — *argyrognomon* Bengtstr ssp (*ssp opulenta* Verity prov.), prep 211, "Alto Adige [N. Italy] 3-VII-1930," ex coll Weeks, M C Z:  $FHU = 0.39 + 0.40 + 0.27 = 1.06$  mm

SCU — *scudderii scudderii* Edwards, prep 168, neotype, "Saskatchewan [N. America] [leg.] Kennicott," M C Z,  $FHU = 0.45 + 0.34 + 0.34 = 1.13$  mm

SUB — *subsolanus* Bremer ssp, prep 242, "Korea [E. Asia], 27-VII-1933, leg. Suk," M C Z,  $FHU = 0.44 + 0.39 + 0.39 = 1.22$  mm

MEL — *melissa samuelis* Nabokov, prep 338, holotype, "[Albany, New York] Orig. Pl 6, fig 6, Butt N. Engl. Cab. S.H. Scudder," M C Z;  $FHU = 0.57 + 0.35 + 0.44 = 1.36$  mm

ISM — *ismenias calabricola* Verity, prep 152, "San Fili (Cosenza), Calabria [Italy] 17-VI-1920 [leg. fam.] Querci," ex coll Weeks, M C Z;  $FHU = 0.74 + 0.56 + 0.49 = 1.79$  mm

I view evolution in *Lycoides* as a twofold process of growth: 1 as a generic growth — involving the whole of the male genitalic structure, so that the absolute size of the uncus (independently from the size of the wings) in its general graduation from the most primitive structures ( $F + H + U =$  about 0.9 mm.) to the most specialized ones ( $F + H + U =$  about 1.8 mm.) is doubled at the maximum limit of development; and 2. as a specific growth — a process acting upon the relation of parts F, H, and U, attacking one part more strongly than the other, whereupon the latter tends to catch up with the former, producing at a certain stage stabilization and equilibrium, which eventually are again broken by unequal growth. Details cannot be discussed here, but it may be noted that the generic growth produces more robust structures in the palearctic section than it does in the nearctic one; that there is also a difference in the rhythm of the specific growth (H being the part conspicuously affected in the palearctic branch, while it is the relation U/H which grows in the nearctic branch where H is more cramped and sluggish); and that throughout the general process stunted by-products occur (holarctically), reduction in absolute size of structure synchronizing here with reduction in size of wings.

I have separated the extremely numerous subspecies of which some 120, most of them badly chosen and poorly described, have names (with up to four synonyms in some cases) into six specific groups. In each there is a considerable range of racial fluctuation in the general size of the structure, and in F/U and a more limited individual fluctuation in H/U, but there is a convenient constance in the structural proportions (and in other structural details not mentioned here) of forms clustering around the main peaks of speciation. These peaks are:

*agnata*<sup>6</sup> Staudinger: small structure, with H smaller than F and slightly smaller than U;

*argyrognomon* Bergstrasser: small to average, with H subequal to F and greater than U;

*subsolanus* Eversmann: average, with H smaller than F and equal to U;

*scudderi* Edwards: small to average, with H still smaller than F and equal to U;

<sup>6</sup> It is not improbable that *agnata* produces in Turkestan a form paralleling *scudderi* (see Nabokov, l.c. 95, *nota*).

*melissa* Edwards: average to large, with H much smaller than F and smaller than U;

*ismenias* Meigen: fairly large to very large, with H much smaller than F and greater than U.

From the arrangement on fig. 1 where selected examples of proportions are given, it will be seen that *argyrognomon*, coming from an ancestral structure from which *agnata* was also derived (and which on the basis of certain data provided by other genera I am tempted, being human, to furnish with certain characters, namely with H and U both equal to 0.2 and slightly smaller than the small F), produces two branches, which run parallel to each other in the general growth of parts. A complete sequence of intergrades (more complete than I originally thought) exists between *argyrognomon* and *scudderi* in the palearctic branch and between *argyrognomon* and *subsolanus* in the nearctic one; and I would not hesitate a moment to assign to *subsolanus* and *scudderi* a subspecific position within the polytypic *argyrognomon* had they not been centers radiating as it were their own forms and, on the other hand, had they been separated from *melissa* and *ismenias* respectively by a definite hiatus, which is not so, since racial intergrades (with a corresponding combination of pattern and structure) exist here too.

It may be added that the genus is distributed from the polar regions to just below latitude 40° in Europe and eastern North America, and to at least 30° in western North America and Asia. Its cradle is a lost country of plenty beyond the Arctic circle of today; its nurseries are the mountains of central Asia, the Alps, and the Rockies. Seldom more than two and never more than three species are known to occur in a given geographical region, and so far as records go, not more than two species have ever been seen frequenting the same puddle or the same flowery bank.

When about to draw up detailed comparative descriptions of the numerous forms, some of them new, involved in my examination of this genus, I was confronted by the fact that the pattern of the Lycænidae had never been adequately analyzed by systematists. On the other hand, none of the works especially devoted to schemes of stripes or lines deal with that family nor can I adapt anything they contain to my needs, since pattern development and correspondence in design values are discussed

by authors (Eimer, Kusnezov, Schwanwitsch, and others) from a point of view with which I entirely disagree.<sup>7</sup> Thus I have been forced to devise a scheme of my own.

Before passing on to this scheme, certain methodological points must be explained. An extremely exact and simple method of mapping the wing characters has been suggested by the fact that the wing is crossed by a set of concentric scale lines of equal breadth (very constantly about 0.06 mm.; sinking to 0.05 only in dwarfs and rising to 0.07 only in giants). Although a few of these lines may fork here and there, their curved course is, on the whole, remarkably regular, and easily followed from costa to dorsum. By stating the meridian of the scale line and the parallel of the vein, the position of any point on the wing can be given, and by counting the scale lines occupied by a marking, the extension of the latter can be adequately measured both in its absolute size and in relation to the whole expanse of the wing. At the root of the wing the scale lines are badly blurred, since the scales here are coarse and irregular. I have thus taken for 0 the scale line crossing the wing through the base of Cu, which is especially convenient as then the axis of the forewing discoidal macule (*i.e.* the two discal or cross veins) coincides more or less with the course of the hundredth scale line (from about the 95th in average sized specimens). Out of a great number of specimens examined and measured, an average looking *Lycaides* was selected the discoidal macule of which lay exactly upon the hundredth scale line (see pl. V, the model of which was a Colorado male of *melissa melissa* Edwards, to which macules R<sup>2</sup> and R<sup>1</sup> have been added from other individuals).

When prolonged beyond the wing, the scale lines are seen to form concentric circles (the curvature of the central and distal lines, forewing, and that of the distal ones, hindwing, showing almost geometrical regularity). These, however, are not concentric with the termen (especially in the forewing)<sup>8</sup> and thus

<sup>7</sup> While deeply enjoying the profusion of fascinating figures provided by those authors, and of course Kusnezov's masterpiece (1915, *Insectes lépidoptères* (Nasekomye cheshuekiylye) 1 (1), in *Faune de la Russie*) is unsurpassed by any other general survey of the morphology of Lepidoptera.

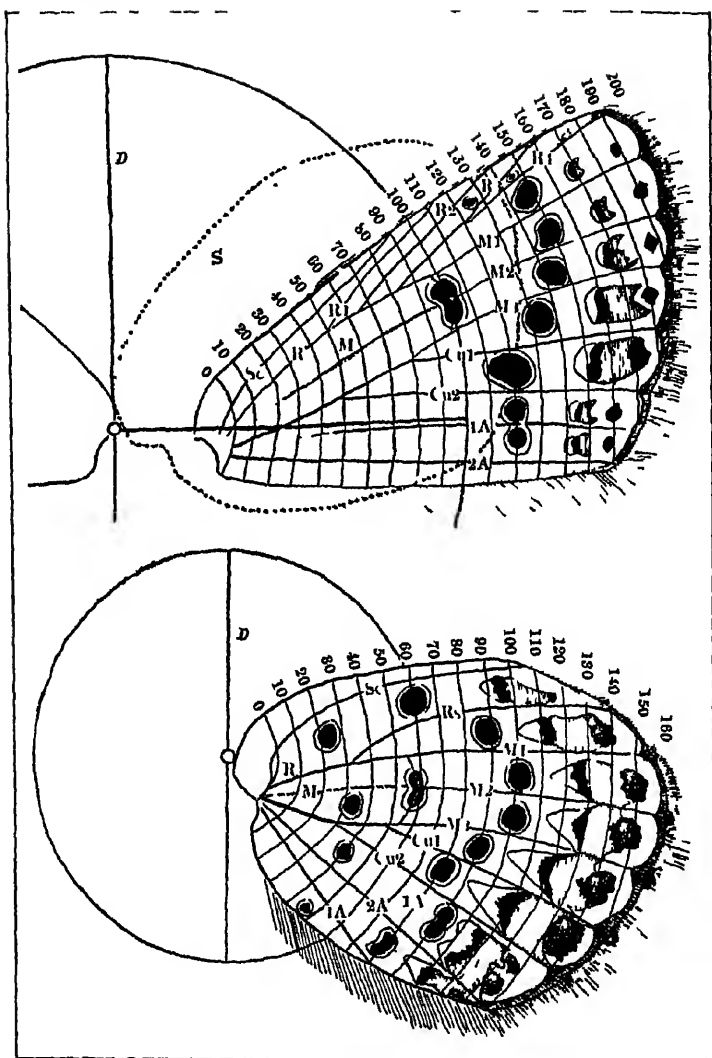
<sup>8</sup> This seems to be a more frequent occurrence in large races than in small ones, and takes place more often distally than basally but I have not yet come to any conclusion regarding the morphological value of this character.

<sup>9</sup> They are concentric to the termen in representatives of other subfamilies, e.g. in *Thecla* Fabricius (*s.s.*).

the outline of the latter seems as it were carved out (as if somebody had taken a sheet of paper that happened to be neatly ruled and had cut out a butterfly, ignoring the lines), after which the transversal disposition of the markings was more or less adapted to the new shape (especially in the case of the more distal markings) in consequence of which they ceased to follow the curvature of the scale lines. Its center in regard to the forewing lies outside the root of the latter at a point corresponding to the root of the forewing on the opposite side of the thorax, *i e.*, at a distance from the base of the wing equal to the breadth of the body at that point; the hindwing center, however, is situated at the very root of the wing (base of costa), so that in order to make the two curvatures coincide, the right hindwing must be placed upon the right forewing in such a way as to have its hub coincide with the root of the left forewing (see plate V). My ignorance of mathematical and mechanical matters is prodigious, and thus I am quite incapable of following up certain lines of thought which these curious facts suggest.

Four veins have been lost in the course of the development of the *Lycænidæ* or of their ancestors. The first to go was an additional radial nervule between ScR and Rs. The next to go was 3A of hindwing. Its more recent disappearance is suggested by the rather constant rheniform shape of macule 2A and by a slight halving of the cretule ( $q\ v$ ) due to the occurrence of a line of weak scales (or a very slight scar) following the old 3A course upon a slightly darker ground. The last two veins to go were 1A and M, probably more or less simultaneously, their remnants being very similar. These remnants are: the still quite definite separation of first macule ( $q.v$ ) in 1A from that in  $Cu_2$  (the oldest set), the somewhat less definite (in hindwing especially so) separation of the second macule ( $q\ v$ ) in 1A from that in  $Cu_2$  (a more recently evolved set) and the distinct scar of vein 1A. I have treated it as an existing vein in my classification of macules. A similar scar is visible in cell RM, the intracellular macule of the hindwing being placed *under* that scar (in other genera there is also an upper macule), and consequently I call it M. The discoidal double macule (RM) placed upon two very weak and often partly obsolescent discals, is very like macules  $Cu_2 + 1A$  (the + denoting their frequent fusion). It seems likely that the third macules in Sc and  $Cu_2$  of the hindwing travelled to their present positions distad after



NABOKOV LYCIDIS ( $\times 5$ )

the disappearance of the veins that had once halved their cells. In the forewing the last radial is numbered  $R_4$  since I have not come to any conclusion as to which of the initial five veins disappeared. The stalking of  $R_1$  and  $R_2$  seems to have occurred after the (rare and weak) first and second macules in  $R_3$  reached their present position from a point adjacent to cell RM; their weak condition seems due to the subsequent segregation in the prison of the shortened and narrowed interspace.

An examination of all known genera of Lycænidæ, clues provided by aberrational individuals and certain ontogenetic data suggest that the maculation of a given interspace develops phylogenetically in result of a series of recurrent waves or rays of pigment, each shorter than its predecessor. An initial wedge-like or gusset-like infuscation, in the proximal corner (against cell RM) of a neutrally colored interspace, grows distad, extending along the interneural fold. This ray broadens distally; the limit (and transverse breadth) it attains varies, and this variability is responsible for the variable position and interneural breadth (filled completely in "striped" forms) of the subsequent macule. The latter is formed by a gradual deepening and concentration of the fuscous pigment at its maximal distal limit, which in the case of the *first macule* to be evolved, is subterminal. The rest of the fuscous extension is weakened, owing to this local concentration, and finally degenerates and disappears, leaving only the residue of its distal limit and the initial wedge-shaped store of fuscous in the proximal corner, whereupon the whole process is repeated (in the majority of the Lycænidæ). It is repeated with a little less vigour but with more variety in the limit of the fuscous extension and hence in the position and size of the *second macule* which is formed discally in the same way as the first was formed subterminally. In some interspaces the number of which varies in the Lycænidæ, a proximal wedge still remains, even after the termination of the second process. At this point it may not have sufficient strength to extend again but a certain concentration of fuscous does occur, with the formation of a half halo distally, (see *halo*), this gusset-like macule appearing to the eye as a sessile *third macule* ready to emerge completely and creep in the wake of the second one. However, in certain interspaces a third wave of fuscous may extend as freely as it had done in the second process and a third macule is formed more or less dis-

EXPLANATION OF PLATE V  
Disposition of pigmented wing-markings in average *Lycæides*  
FOREWING

From base of interspace	Macule (second)	Stretch (H L)	Semi macule (inner fr t)	Interval I with aurora	Preterminal mark (ou er fr t)	Terminal space	Terminal line	Terminal space
83-142	R <sub>4</sub> 142-152	152-168	R 168-170	170-186 (170-177)	R 186-190	190-198	R <sub>4</sub> 198-200	R at 10
100-144	M <sub>1</sub> 144-153	153-170	M <sub>1</sub> 170-172	172-187 (172-175)	M 187-193	19-198	M <sub>1</sub> 198-200	M at 100
100-138	M 138-149	149-166	M 166-168	168-185 (168-174)	M 183-189	19-198	M 193-195	M at 100
80-128	M 128-139	139-155	M 158-161	161-176 (161-175)	M 176-184	184-195	M 188-190	M at 101
48-111	Cu <sub>1</sub> 111-126	126-151	Cu 151-154	154-168 (154-168)	Cu 168-176	176-181	Cu 181-183	Cu at 100
0-116	Cu 116-123	123-144	Cu 144-146	146-157 (146-151)	Cu 157-163	16-175	Cu 173-175	Cu at 100
0-116	1A 116-123	123-145	1A 143-145	145-156 (145-148)	1A 156-160	160-166	1A 166-168	1A at 100

Other macules. First discoidal RM (= 10 scale lines on 100) Lateral macule R (= 5 scale lines on 100), Second macule R (= 4 scale lines on 145), First macule R<sub>4</sub> (evanescent)

## HINDWING

0-85	Sc 55-65	65-92	Sc 92-97	97-112	Sc 112-117	117-129	Sc 129-130	Sc at 105
31-84	Rs 84-93	93-110	Rs 110-115	115-131	Rs 131-141	141-148	Rs 148-150	Rs at 140
57-97	M <sub>1</sub> 97-105	105-122	M <sub>1</sub> 122-127	127-145	M <sub>1</sub> 145-155	155-160	M <sub>1</sub> 160-162	M <sub>1</sub> at 155
57-96	M <sub>1</sub> 96-104	104-124	M <sub>2</sub> 124-130	130-141	M <sub>1</sub> 141-154	154-160	M <sub>1</sub> 160-163	M <sub>1</sub> at 163
48-86	M <sub>1</sub> 86-93	93-115	M <sub>1</sub> 115-120	120-133	M <sub>1</sub> 133-147	147-155	M <sub>1</sub> 155-157	M <sub>1</sub> at 158
30-76	Cu <sub>1</sub> 76-84	84-105	Cu <sub>1</sub> 105-112	112-130	Cu <sub>1</sub> 130-143	143-147	Cu <sub>1</sub> 147-150	Cu <sub>1</sub> at 151
0-87	Cu <sub>2</sub> 87-93	93-104	Cu <sub>1</sub> 104-109	109-120	Cu <sub>2</sub> 120-129	129-139	Cu <sub>2</sub> 140-143	Cu <sub>2</sub> at 145
0-88	1A 88-93	93-102	1A 102-107	107-118	1A 118-127	127-133	1A 133-136	1A at 140
0-77	2A 77-82	82-98	2A 98-103	103-112	2A 112-120	120-124	2A 124-125	2A at 130

Other macules Third in Sc (19-27), Third in Cu<sub>1</sub> (17-13), One in 4A (43-46), First RM (= 5 scale lines, on 57), Second (R) M (= 6 scale lines, on 32).

cally. The occurrence of yet a fourth process has been noted only in a limited number of forms (*e g* in the Lycanidae like patterns of certain Riodinidae)

Having retained a certain vitality even after it has been formed (or owing to an extension of the wing membrane in the termen) the first macule splits, *i e*, the distal part stretches and snaps off and then a fissure is formed, within which very often the neutral ground undergoes an auroral and/or structural differentiation. In certain species where the general process started very early (*e g* in *Tomares*) a splitting occurs too in the second macule of the interspace (and the resulting fissure is also differentiated aurorally from the ground, or, *e g* in *Cosmolyce baeticus* Linn (*Catochrysopinae*) is filled with white structural scales).

Thus the difference we see in the position of the same macule when comparing two specimens is really a matter of different limits attained by the sequence of initial rays. In comparing specimens, however, the eye sees those differences as the result of the actual "movement" of this or that macule distad and this is a true impression, inasmuch as a macule is formed at different limits of the distally progressing infuscations. On the other hand, the white cretule capping a semimacule proximally (and produced not only by a gradual draining of the ground on the part of the first macule but also by the force of the stretch attending the splitting of the latter), is not at all "growing basad" as one is tempted to see it in some forms. In direction of growth and in shape it adheres to the general standard, for it should be noted that the essential shape of a macule and its halo, of a semimacule and its cretule, of an interval and its aurora, of a præterminal mark and its scintilla, is obovate, sagittate, cordate, arcuate, with the wider part directed distad; this outline repeats that of a sessile macule which in its turn conforms to the shape of the apex of the cell; or in other words, the shape of any of these markings renders macrocosmically the shape of each distally broadening scale and microcosmically the general fan-wise expansion of the wing and its cells, and is influenced in details of outline and direction by the apical and/or cubito-anal development of the termen (alone the ciliary markings, lying as they do beyond the membrane of the wing, point distad). I see no trace or possibility of the basally directed development of

markings postulated by authors to explain certain phenomena of pattern.

Pseudo-linear arrangements of markings, insofar as they occur in the Lycænidæ, must be also briefly noted. The terminal line is the only sequence of interspatial markings for which I employ the word "line" at all, as it is the simplest term. Although it may be the remaining maximal limit of an infuscation preceding the formation of the first macule, its connection with ciliary elements places it in a separate class (submarkings) from the macules. It would not have mattered much had I called it "limbal" with Herrich Schaffer or "extreme" with Schröder, or "marginal" with the British authors. But if I called it "Line I" with Eimer (who has eleven of them numbered basad) or "XII" with Verity (who has twelve of them, numbered distad), or "22d" with Kusnezov (who has twenty-two) or "external I" with Schwanwitsch (who has three such external ones) or "Randbinde I" with Suffert (who has two such "Randbinden"), then I would be instantly involved in a wild confusion of man-made patterns. I fail to perceive in the Lycænid wing any suggestion whatsoever of initial transverse lines or stripes forming, or having formed, an integral part of the pattern and lending themselves to classification and "homologisation." In Lepidoptera generally, the limit of a lost ancestral infuscation in any place within a given cell, may produce, in combination with a similar limit occurring at more or less the same point in an adjacent cell, what may be loosely termed a line. When this occurs in several interspaces without a special macular differentiation in any, and is followed by various adjustments and adaptations to the distal outline of the wing in the course of more or less synchronized stages of posterior and anterior development of the termen, then the line may seem very perfect to the eye, but it is the *result* of those processes and not a "primitive" line which Mother Nature automatically traced with her brush on one butterfly after another as soon as she had stuck on the wings.

It is never the line as such that "breaks" into ocelloid macules. Such macules are formed by the initial spread of fuscous, or not at all; and sometimes when the latter had been strong enough interneurally to span that space, the resulting macule may be broad enough to "connect" with any other macule (not

necessarily of its "own," *i.e.*, synchronous series) formed in an adjacent cell, or, more seldom, during the process of concentration + draining + isolation the macule may steal additional pigment from the ground of a neighboring unoccupied interspace and form therein part of its halo

Even in the most zebroid species of *Catochrysopinae* or *Thecline*, the macules peep through their linear disguise. If on the basis of some synthetic "prototype" we tried to classify these lines (say Lx, Ly, Lz), we would be continuously mistaking proximal and distal parts of split macules for components of different linear sets, or, in other cases, would come to the nonsensical conclusion that the same macules (*e.g.*, the second macules of the posterior interspaces) form the lower part of Lx in one species, the lower part of Lz in another, and an intermediate Ly in a third. The illusion of a stripe in the subfamilies mentioned is due to several variously combined factors. The macules in two or more adjacent cells may be bar-like, with halos formed only laterally. Sessile third macules (half haloed, *i.e.*, only distally) wedged proximally in their interspaces, *e.g.*, in R<sub>1</sub> (just above the outer part of a split discoidal macule) and in M<sub>1</sub> (just between the discoidal outer portion and the second macule in Cu<sub>1</sub>), combined with a posterior sequence of second macules in Cu<sub>1</sub>, Cu<sub>2</sub>, and A1 may complete the illusion of a stripe crossing the wing radially. Moreover, when these macules are comparatively weakly pigmented, the eye tends to confuse them with portions of ground color; or a complete transverse section of brown ground between "white lines" (formed by the inversely in regard to each other directed half halos of two different macular series) may be mistaken for a "stripe." Remarkable cryptic phenomena in some genera produce yet other illusory patterns, and a "white line" that the eye follows across two cells may really consist of a proximal half-halo in one and a distal one in the other. Finally, it should be kept in mind that among the second macules *any* three may be *always* seen in line provided that two of them (such as A<sub>1</sub> and Cu<sub>2</sub> or M<sub>1</sub> and M<sub>2</sub>) are those which, throughout the family, are more or less linked together in their movement distad. Although quite possibly my judgment may be affected by the fact that the genus which I have especially studied and to which we must now turn is most honestly "spotted" — and also by the fact that I am interested more in what happens within a given interspace than in the

wing pattern as a whole, still I am quite sure that it would be a waste of time to try and twist this or that illusion created by a transverse combination of *Lycænid* macules into this or that "prototypical line"

#### THE WING-CHARACTERS OF THE GENUS *LYCÆIDES*

The categories to be discussed are: I. Size and shape. II. Ground. III. Cyanic overlay. IV. Vadosal elements. V. Scintillant elements. VI. Hairscales. VII. Terminal submarkings. VIII. Maculation (Number of specimens of *Lycæides* forms examined: 959).

##### *I. Size and Shape*

Length of forewing (from base of  $Cu$  to end of  $M_1$ ) in smallest individual measured: 7.5 mm., with length of hindwing (from base of  $Cu$  to end of  $M_2$ ): 6.5 mm.; in largest individual measured these lengths are: 18.5 and 15 mm. respectively, thus giving a range of 11 mm. and 8.5 mm. Number of scale lines ranging from 140 in forewing and 115 in hindwing to 260 and 210 respectively. In average sized forms the number of scale lines varies from 190 to 210 in the forewing and from 160 to 170 in the hindwing. The hindwing varies less than the forewing in the number of scale lines but more in shape. The most distal point of the termen of the hindwing lies either rather anteriorly (*high angled* shape), namely between  $M_1$  and  $M_2$ , or more posteriorly (*low angled* shape), between  $M_2$  and  $M_1$ , or rather exactly at the end of  $M_2$  (*average* shape); or the termen is evenly rounded, *i.e.*, runs almost concentrically to the scale lines in the stretch from  $M_1$  to  $Cu_1$  this however only occurring in stunted individuals. In especially high-angle individuals the scale line which in the hindwing coincides with the tip of  $Cu_1$  (further on termed s.l. $Cu_1$ ) abuts anteriorly at the tip of  $Rs$  and cuts off a terminal segment of about 20 scale lines at the point of its greatest expanse (in interspace  $M_2$ ); but another individual with the same number of scale lines in  $M_2$  will seem less conspicuously angled if s.l. $Cu_1$  reaches anteriorly a more distal point (say, between  $Rs$  and  $M_1$ ) since the segment cut off by the line will occupy a lesser number of scale lines. In low-angled forms s.l. $Cu_1$  may abut at  $M_1$ , thus cutting off the terminal parts of only two interspaces instead of four. Finally the segment itself may be either of a fuller or more apical



shape, and when this difference exists the wing of one individual may look rounded and that of another angular though actually both are high-angled (the tips of  $Cu_1$  and  $Rs$  being connected by the same scale line in both). In the *circular* shapes, found in stunted specimens,  $sc\ l.Cu_1$  abuts at  $M_2$ , practically coinciding with the termen and thus cutting off no segment at all. In the forewing the variations are less conspicuous but there is generally some correspondence between the wings since in high-angled forms the forewing is apt to be "pointed," *i.e.*, with the scale line which connects the tips of  $M_1$  and  $R_1$  cutting off a larger segment (about ten scale lines in a "rounded" forewing and about twenty in a "pointed" one). *Short* forewings (where the proportion between breadth and length is less than five to four) and *long* forewings (when more than five to four) may have, together with difference in shape, a certain significance in subspecific values. It may be added that there is a certain connection between shape (*i.e.* vigor of growth in termen) and color (vigor of pigmentation). A low-angled shape is generally associated with weakly pigmented undersides, and these are generally strongly pigmented in races with high-angled hindwings.

## II. Ground.

Upperside, both sexes: ranging from neutral fuscous or weak brown to blackish. Costa in hindwing above  $Sc$  of a scaly neutral fuscous still weakened by the addition of colorless or very faintly iridescent scales. In a few female forms, with greatly developed upperside auroræ (see VIII 4), the fuscous ground may be intermixed with sparse auroral scales (the beginning of a brightening of the ground which in both sexes of *Plebulina* is well on the way to complete predominance, as occurring in *Lycæniæ*).

Underside, both sexes: ranging from fawn to brownish; or from white (colorless scales completely covering some, or all, neutral ground areas) to whitish fawn, or producing a greyish or bluish effect due to the even admixture of colorless or faintly iridescent scales with a more or less developed ground pigmentation. Occasionally the veins and the vein scars appear marked in a lighter shade. The forewing is generally of a slightly more diluted and smoother tone than the hindwing, and in one and same race the ground of the female is generally slightly richer than that of the male.

### III. Cyanic overlay.

Upperside, both sexes: structural scales invading the ground from the base with more or less vivid violet blue; partly (a) or almost completely (b); (a) clothing or dusting only certain areas (*i.e.*, absent discally, or only empurpling the cretules (*q.v.*) in the female) or reduced to a few scales at the base; (b) overlaying the ground evenly or more or less sparsely (*i.e.*, leaving out minute bald patches and the vadosal elements, *q.v.*) but always keeping clear of the costa in both wings, of most of the subcostal area in the hindwing (see further, V, 1 and IV, 5, 6) and reaching distad a maximum limit situated at a distance of about three scale-lines from the termen (see IV, 4) and less sharply defined in the female than in the corresponding male, the intensity and tint of the violet blue depending upon the density of the scaling producing it, as well as upon the fundamental pigmentation of the wings.<sup>10</sup> Reduced or absent in the female considerably more often than in the male, where its complete absence occurs only in a few races.

### IV. Vadosal elements

Racially more or less characteristic portions of fuscous upper-side ground inasmuch as they are isolated, defined, and strongly pigmented in forms (mainly male) with dense cyanic overlay which in its spread distad leaves "dry" or fails to reach always three (fourth, fifth, and most of sixth), but often all of the following ten ground elements: the (1) *vadosa* proper: a longitudinal stretch of ground thickly or finely sheathing a vein throughout its course (or only terminally: (2) *terminal vadosa*), often broadening towards its tip (on veins  $R_1/R_s$ / down to 1A) to form there the basally tapering (3) *vadosal triangle* (in shape and position a more or less exaggerated silhouette of the corresponding inner triangle *q.v.* of the underside) which may occur independently and which in its turn fuses with (and rep-

<sup>10</sup> Culling at random definitions of these shades from original descriptions of *Lycæides* forms, I find dull violet, shiny blue, glossy violet blue, silky lilac blue, deep purple, hyssop violet, lavender blue, prunose blue, pinky lilac, violet with a pink tinge, and at least two authors have found in their races a greenish cast. All these, more or less subjective, color impressions are worthless as racial characters unless the combination of the two factors producing the color effect (in fresh specimens) be carefully analyzed in comparison with fresh specimens of other races (of the same and of different species).

resents the neural thickening of) the (4) *vadum*.<sup>11</sup> a linear or more extensive marginal space of pigmented ground, from apex to tornus, between the limbal limit of the overlay and the termen, at its narrowest reproducing the terminal line of the underside, apically turning into the delicate (5) *costal vadum* of the forewing, merging with the distally fuscous Sc area ((6) *subcostal vadum*) of the hindwing, distally connected with the vadosal fringe *q.v.*, and with the outer triangles *q.v.* and proximally (in the hindwing) often joined more or less thickly by means of an (7) *internodal vadosa* with the (8) *insula* proper (as differing from (9) *insula Rs II* and (10) *insula RM*) which is a frequently occurring, more or less isolated, roundish blotch or point of conspicuous fuscous repeating in all or some interspaces the corresponding præterminal mark *q.v.* of the underside (also, but usually faintly, macule *Rs II*, and in some cases, mainly in females with strong overlay and mainly in forewing, macule *RM*), and sometimes appearing as a blacker spot within the vadum when the latter is extensive enough to surround it, but not sufficiently dark to merge with its pigmentation.

#### V. Scintillant elements.

1. The *scintillant pulvis*: structural scales more or less extensively dusting with metallic greenish blue (in strongly pigmented forms) or turquoise (in weakly pigmented or white forms) the ground at the base and in the anal interspaces of the underside; mainly in hindwing; sometimes quite absent or reduced to a few scales next to the body. Upperside: confined to the dorsum and to the proximal and posterior part of the subcostal interspace of the hindwing and intergrading there with the main overlay; in a few female forms, occurring also on the upperside of the forewing where it clothes the costa and lines the veins discally (*i.e.*, more or less corresponding to the distribution of short white hairscales in the male); consisting there of rather coarse scales of a dull turquoise tone suggesting "dead" parts of the cyanic overlay.

2. The *scintilla*:<sup>12</sup> a variable number of scintillant scales more or less thickly and evenly grouped, overlaying the pigment

<sup>11</sup> "fuscous border," "bordure noire," "Distal Rand," "terminal border," "kraievaya polosa," "marginal streak," etc., of authors

<sup>12</sup> Possibly remnants of a dense scintillant pulvis which had covered the whole of the hindwing, completely swamping all its markings, at some period in the evolution of the *Lycenidae*, as it still does in certain Asiatic species of *Albulina*,

of each præterminal mark of hindwing underside; tending to be gradually reduced from  $M_1$  or  $M_2$  costad, and often lacking in the anterior interspaces, but seldom missing in the posterior ones, very poorly developed in some forms but only individually quite absent; in most cases placed rather proximally upon the mark, *i e*, not reaching its distal limit, so that the latter spreads out beardlike from underneath the scintillant incrustation, if viewed from the termen; (the following more individual than racial variations in position are to be noted since any one of them can be stabilized specifically in other genera) sometimes coming in complete contact with the aurora (*q.v.*), but often well separated from it by a tendency to occupy a median, or even distal, position within the mark, sometimes absent from a more or less conspicuous point in the center (upon the inter-neural fold) which thus forms a blackish pupil; in some cases agglomerating band-like across the mark, or distributed unevenly, with patches and dots of black showing at different points, but in a few cases overlaying the mark completely (with or without a pupil), or, as it were, overlapping or replacing it in cases when the pigment of the mark tends to obsolescence or is quite gone, in shade varying (racially, inasmuch as the pigmentation varies racially) to the naked eye from turquoise (in poorly pigmented forms) through peacock blue (at an average or reduced development in well-pigmented forms) to golden green (when completely overlaying a strongly pigmented mark), but hardly distinguishable from the scintillant pulvis under lens (both sets of scales being turquoise), the aforesaid variations in color depending on the angle of light, the compactness of scales, the pigmental basis and frame — and a subjective approach on the part of the observer.

#### VI. *Hairscales (and androconial scales)*

1. *Hairscales* of forewing, in male: very short, white, bluish, or pale violet blue (according to light); of a bristly appearance under lens; projecting distad (apically and tornad when paired on a radial vein, on each of which they may form a sequence of basally pointed arrowheads) and sparsely to rather densely distributed (more or less distally) within cell RM and throughout the circumcellular area distad, lacking at the base of its posterior

*Glaucopteryche*, *Lycæna*, and *Tomares*, and which subsequently had disappeared, leaving the scintillæ as seapools are left by the sea at low tide

part, stopping or diminishing in number at or beyond limit II (*i.e.* the limit corresponding to the emplacement of second macules, *q.v.*, of the underside) but sometimes just reaching in hindwing (where however they are somewhat less conspicuous throughout than in the forewing) limit I (*i.e.*, the limit corresponding to the emplacement of the semimacules *q.v.* of the underside). Above RM in forewing mainly along veins Sc, R<sub>1</sub>, R<sub>2</sub>, and R<sub>3</sub>, agglomerating on their slopes (giving the vein a pinnate appearance) when the overlay is dense enough to eliminate the vadosæ in the costal area which then seems, especially in freshly emerged specimens, rather densely powdered with white (*costal pulvis*)

2. *Male androconial scales*: a microscopical character: minute battledore-shaped scales, in outline, size, length of pedicule and number and density of "knots" varying in individuals of some forms, racially more or less constant in others (especially in stunted or overdeveloped forms), and often duplicated by specifically different races (and thus lacking the specific importance assigned them by Courvoisier, 1917, on the strength of scanty, and more or less misidentified, European material).

3. *Costal fringe*: short hairscales (allied to the male hairscales) in both sexes rimming the costa with white and very conspicuous in specimens with a strongly pigmented costal vadium (IV, 5).

4 *Basal cilia*: long and very long silvery white, bluish or drab hairscales clothing basally the upperside of the hindwing (reduced in forewing), sweeping in a distal and then downward direction across the proximal part of cell RM, extending rather far into interspace Cu<sub>1</sub> where they just reach limit II, still further in Cu<sub>2</sub> + 1A (almost to limit I), and spreading from base into 2A and 4A, where they stipple the scintillant pulvis of the dorsum.

5. *Dorsal cilia*: white, or producing on the upperside a light blue effect as if daintily dyed. Springing from a very faintly fuscous *dorsal margin* and sometimes slightly infuscated themselves. Equal to about 10 s.l., somewhat shorter in forewing.

6. *Terminal cilia* as seen from the underside: long hairscales (equal to about 10 s.l. in forewing and to 12 s.l. in hindwing) attached to the termen, proximally denser than distally; silvery white or with slight bluish or mother-of-pearl reflections in certain lights; sometimes, especially in females, more or less

infuscated, ranging in shade from drab or pale fawn to brownish; completely pigmented or in part, *i.e.*, only proximally or only distally and then either from tornus to apex throughout, or only along a limited section of that range.

7. *Vadosal fringe*: consisting of rather short pigmented hairscales rooted in the vadum, upperside, and thus doubling basally the terminal cilia of the underside; usually equal to 4 s.l., tending towards the fuscous of the vadum from which sometimes it may be almost indistinguishable to the naked eye.

Viewed in cross-section the short dark vadosal fringe (rooted in the still darker vadum) is seen to overlay the long white underside cilia (rooted in the distal edge of the terminal line) to about  $2/5$  of their length. The very slight jutting of the dark hairscales of the terminal line just beyond the rim of the membrane forms a kind of prop for the base of the ciliary hairs which thus are encased between it and the vadosal fringe. If the cilia are viewed from the under surface by the naked eye, an illusory more or less dark ciliary line seems to run along the middle of their transverse stretch: this is due, first, to the cilia abruptly losing their quilted appearance at  $2/5$  of their length where the edge of the upperside vadosal fringe stops, and second, to minute portions of this edge being discernible in between the white ciliary hairs, as they become less dense distally. If, moreover, the distal part of the cilia on the underside happens to be infuscated and if this infuscation begins at just over  $2/5$  of the length distad, then on the upperside too there is a similar illusion of a ciliary line (but of a light one this time), due to a narrow stretch of unpigmented cilia showing between the distal infuscation and the edge of the dark vadosal fringe which shuts off most of the white basal part of the underside cilia. My abundant material has not proved the occurrence of a true ciliary line in *Lycæides*, *i.e.*, of an actual infuscation of each ciliary hair only at its middle, or of shorter hairs (among the longer ones) infuscated only at the very tips.

#### VII. *Terminal submarkings of underside.*

1. The *terminal line*: edging the termen proximally with more or less dense fuscous from about the middle of i.Sc. in secondaries, and from the tip of  $R_1$  in primaries, to the tornus; consisting of very short distally directed hairscales (which very slightly jut beyond the termen), and in its interspatial aspect

resembling a garland more or less raised and thickened at both ends. Very thin and faint in weakly pigmented form.

2. The *inner triangle*: a fuscous triangular basally tapering mark formed upon the termination of each vein (mainly from  $M_1$  to  $Cu_2$ ) by the meeting of the thickened praneural ends of two adjacent sections of the terminal line. Not necessarily absent in weakly pigmented forms. See also IV, 3.

3. The *outer triangle*: a fuscous subtriangular distally tapering mark formed upon the proximal part of the terminal cilia (and also occurring sometimes upon the vadosal fringe of the upper side) independently from the general pigmentation, if any, of the latter and placed directly opposite (base to base) the inner (or the vadosal) triangle, which it repeats in reverse, except that its base is usually narrower and its point more or less truncated. Mainly in hindwing. Seldom leading to any conspicuous scutellation in the forewing.

#### VIII. Maculation of underside

Counting from termen basad a *first macule* (split into inner and outer part) and a *second macule* are both represented in Sc, Rs, and 2A of hindwing, in  $R_3$  (where, however, they occur seldom and are always much reduced) and  $R_1$  of forewing, and in  $M_1$ ,  $M_2$ ,  $M_3$ ,  $Cu_1$ ,  $Cu_2$ , and 1A (small in the two last) of both wings. A *third macule* supplements the set in Sc and  $Cu_2$  of hindwing. Moreover, there is a small *lateral macule* in 4A of hindwing caught in the blind alley of the dorsum and sometimes a small lateral macule is somewhat similarly trapped in  $R_2$  of forewing (where the eye sees it as "belonging" to the transverse series of second macules). In both wings the discoidal cell (a double interspace R and M) has its own *first* (double) *discoidal macule*,<sup>14</sup> the rheniform RM, traversed by the discals (the outer segment of its R part and the outer segment of its M part form in relation to the second macules  $M_1$  and  $M_2$  a pair of sessile third macules — an important point in the case of certain other genera). In the hindwing there is a *second* (single) *discoidal macule* within the cell under the scar of vein M. All the macules are of a more or less deep fuscous and are rimmed with structural scales, *i.e.*, *halos* (produced by the macule having drained during its period of formation and concentration the initial pig-

<sup>14</sup> Among the names employed by authors for this double macule are "discal streak," "bar," and "disco-cellular lunule."

ment in its immediate neighborhood). The halves of the halo which has split together with each first macule are termed *cretules* but only the proximal one is represented in full. The inner part of each first macule is the *semimacule* (capped or rimmed proximally by the *cretule*) and the outer part is the *præterminal mark* (adorned in hindwing with the *scintilla*). The fissure between the two parts is the *interval* (extending in average size races from about 5 to 20 scale lines in  $Cu_1$  of forewing, always correspondingly more in hindwing) which may be, and generally is, more or less completely filled by the *auroral element* — an agglomeration of brightly colored scales differentiated from the ground, and associated with the splitting of macules. In the female the semimacules and præterminal marks may appear in darker pigment within the fuscous ground of the upperside, and the series of *auroræ* is often repeated, completely or in part; but in the males with average overlay only the præterminal marks appear (as *insulæ*) although in very rare aberrations the posterior *auroræ* of hindwing may be repeated (as happens more often in forms of *Plebejus argus* L., becomes fairly normal in its allies and is characteristic of the smaller *Icaricia* where the auroral development resembles that found in certain *Glaucopsychinæ*). All parts of the first macule are less developed in the forewing than in the hindwing, where again those in  $M_1$  and especially  $Cu_1$  (there extremely developed in "tailed" genera) are stronger than in the rest of the interspaces.

#### VIIIa. Elements of First Macule.

1. *Semimacule*:<sup>11</sup> generally crescentic, sagittate, or deltoid (pointing basad upon the interneural fold) in hindwing (from i Sc to  $A_2$  incl.); when well developed, spanning almost the whole breadth of the interspace, except in Sc, Rs, and  $M_1$ , where it is shorter and often reduced to an uneven bar-like shape; often tending to the latter shape in all interspaces of forewing (from i  $R_1$  to i  $1A$  incl.) where each is shorter than the corresponding one of the hindwing and may seem blurred to the naked eye owing to a weaker pigmentation. Variable in longitudinal extension; quite absent only in extreme individuals of very weakly pigmented races.

<sup>11</sup> The "rather narrow bent lunule" of Scudder and the "crescent," "flat crescent," "arrowhead," and "chevron" of Chapman, those two authors have left by far the best descriptions of the *Lycæides* pattern.



2. *Cretule*. capping proximally each semimacule in both wings; more or less conspicuously white or whitish (almost invisible on the powdery white ground of some forms) or, very rarely, retaining some diffuse pigment; crescentic or sagittate or squarish, *i.e.*, more or less in keeping with the shape and size of the corresponding semimacule, but usually somewhat more pointed and larger; sometimes so greatly developed as to seem to fuse with the halo of the corresponding second macule (actually it is the halo which intrudes), and then appearing raylike if the whole system of macule I is transversally reduced; at other times, however, especially in hindwing where the semimacules are better developed, and more often in females, occupying the whole breadth of the interspace for a certain distance basad from semimacule before "terminating" crescentically or tapering to a point (phylogenetically, however, expanding distad from that point), so that the sequence of *cretules* (especially if they fuse with the halos of series II) has been described by observers as a "white band"; in some well pigmented forms very small or quite absent, especially in forewing. Appearing on the upperside in some females, in whitish or bluish (or violet as portions of the overlay).

3. The *præterminal mark*: tending to be heart-shaped (expanding distad) in hindwing where it is generally strongly fuscous and contains the scintilla; roughly rhomboidal or (when reduced) bar-like in forewing where its pigmentation is weaker; situated in the same interspaces as the semimacule distally to the latter, and varying in size accordingly, tending to complete obsolescence in some weakly pigmented forms, although the scintilla may be retained (see V,2).

4. (The remnants of an) *outer cretule*: colorless (white) scales diffused in the ground of the crescentic terminal space with which, when the latter lacks pigment altogether, it is practically synonymous; usually more conspicuously white in hindwing but sometimes very much so in  $Cu_2$  of forewing in otherwise well pigmented forms. Appearing on the upperside in some females with the same variations as 2.

5. The *aurora*: racially varying in extension (together with that of the interval) and in transversal development, (together with that of the semimacule); on the underside in both sexes (but somewhat better developed in the female); ranging there from light yellowish to deep reddish orange; of

a more velvety appearance on the upperside of the female where it may be under or overdeveloped in comparison to the underside in the same specimen and where its color ranges from a bleached neutral shade to a rich fulvous (the slight discrepancy in tone between the two surfaces being due to a difference in the degree of the ground pigmentation as well as to the sparser spread of colored scales forming the average upperside aurora); at its full development on the underside snugly fitting into the interval between the semimacule which caps it and the corresponding præterminal mark which it caps in its turn; often represented in all intervals; tending, however, to be ill-formed, underdeveloped, or absent in the primaries, especially in  $R_1$ ,  $M_1$ ,  $M_2$ ,  $Cu_2$ , and  $A_1$  (termed the *weak interspaces*) of the male underside and of the female upperside; in a few female forms, however, hypertrophied on the upperside and especially conspicuously so in the forewing, the sequence reaching there from costa to dorsum and swamping a stretch corresponding to that occupied on the underside by the inner cretule + semimacule + aurora, thus forming a broad "band" with a more or less diffuse proximal edge (see also II); when underdeveloped the aurora edges the interval always proximally, *i.e.*, does not reach the præterminal mark in its growth distad from "beneath" the semimacule (the remaining gap being either concolorous with the ground or colorless). It is the first to develop, or the last to go, in  $Cu_1$  (with its neighbor in  $M_3$  following closely). Completely absent only in extreme individuals of weakly pigmented forms.

5a. *Cusps*: when fully developed and especially in  $Cu_1$  and  $M_1$  of the hindwing underside, the crescent of the aurora is prolonged distad by two (inner and outer) pairs of cusps and occupies the whole breadth of the interspace; the inner cusp clasps the præterminal mark laterally, the outer one runs next to the vein and fuses upon the vein with the outer cusp of the adjacent aurora to finally penetrate and bisect the inner triangle of the terminal line; in the forewing and in the anterior interspaces of the hindwing the outer cusp tends to be absent, so that the auroræ (and their semimacules) do not touch the veins and are separate from each other.

5b. *Lacrimæ*: in some richly pigmented and strongly developed forms there are on the underside two or four streamlets of blurred auroral pigment coming as it were from beneath the

præterminal mark, and "trickling" distad across the terminal space (one, or a pair, on each side of the interneural fold)

*VIIIb. Second, Third, Discoidal, and Lateral Macules.*

*Second macules:* if a *Lycæides* forewing is placed with its base towards the observer and its discal constellation is viewed from an imaginary horizontal line joining the opposite ends of the discals, the *second macules*, ( $R_4$ ),  $R_1$ ,  $M_1$ ,  $M_2$ ,  $M_3$ , and  $Cu_1$ ,<sup>15</sup> all of which have radiated from positions adjacent to cell RM, are seen to form a fairly regular rather weak arc, sloping somewhat sideways in relation to the rheniform macule RM, as if tipped by a slight apical pull (process 3). The twin macules  $Cu_2$  and 1A lie outside the lower end of the arc, *i.e.*, lead an independent existence, having reached their present position (phylogenetically, from an enormously remote starting point in comparison to the starting points of the other macules) in result of a (process 2) cubito-anal stretch of the membrane (so conspicuously retained in some genera) that had occurred at some period in the evolution of the narrow and ovoid ancestral forewing (with a similarly shaped hindwing) prior to the comparatively recent generic and tribal apical development (process 3) which in a way has tended to repeat the initial growth and elongation of the ancestral wing (process 1). These stages of unequal growth and of subsequent compensatory readjustment may be compared to the already discussed evolutionary phenomena in the case of the uncus

It would be necessary to analyze a great number of generic patterns (in the *Plebejinæ* alone striking variations on a P-shaped basis occur in *Agriades*, and a remarkable apicoid angle is formed by the macular constellation in *Albulma*) in order to bring out certain features of the position of second macules in *Lycæides*, but this would transcend the scope of this paper. In selecting the three positions (1 proximal, 2 central, and 3 distal) given for this genus, stress has been laid on the progress of macule  $Cu_1$ , but actually this may be combined, at these and intermediate stages, with shiftings on the part of the anterior series which may be removed from RM further than it is shown here. Fig. 2a shows the generic starting point of  $R_4$  whose initial rather distal position (in regard to even such

<sup>15</sup> When no Roman number is appended to the symbol of the macule, the reference is to the second macule (e.g.  $Cu_1 = Cu_1$  II)

genera in *Plebejinæ* where the constellation is of the same type) coupled with the also rather distal position of  $R_2$  or  $R_3$ , when occurring (not shown in the figures), is instrumental in weakening the curvature of the arc and producing its "sideways" position already discussed. The same figure also shows the most proximal position of macule  $Cu_1$  which is at this stage in an oblique line (the *radial slant*, reoccurring throughout the family) with RM and  $Cu_2 + 1A$ . Under RM this imaginary line diverges distad from the latter's scale line to finally cross the scale-line of macule  $Cu_2$ . Fig. 2b shows a middle position which is most frequently found in this genus. Fig. 2c shows the most distal position of  $Cu_1$  (except that the whole series can move still further if the semimacules are further removed than they are in average forms) when the series is roughly adapted to the sequence of the first macules which in its turn is sub-parallel to the outline of the termen. The tendency to assume one of the two extreme positions (a, b) is sometimes a racial character.

In forewings of average extension (about 200 s.l. in  $M_1$  and 185 in  $Cu_1$ ) and with semimacule  $Cu_1$  having reached s.l. 150 or thereabouts, the range of movement of the center of macule  $Cu_1$  (and it is this center which is referred to throughout), is from s.l. 105, at which initial point in *Lycæides* it is about 50 s.l. removed from the apex of its cell (which thus is less than macule  $R_1$  has travelled from the apex of cell  $R_1$  but *more* than the distance covered by the other anterior macules in regard to their respective cells—although curiously enough all describers, being obsessed by the notion that macules must form "lines," speak of  $Cu_1$  in this position as "advanced basally") to s.l. 135, at which point it has 50 scale lines to go if it wishes to reach the termen, which of course it cannot, since the split first macule occupies the remaining space. Thus its range of activity is 30 s.l. which is somewhat less than  $1/4$  of the length of its interspace and about  $2/5$  of the distance from the proximal position of  $Cu_1$  to the termen (this range varies racially). The width of the interval between semimacule (inner I) and præ-terminal mark (outer I) (see fig. 2d, e, f) is mainly dependent on the position which the former had reached when the macule I split (the outer part wandering distad). The breadth of the fissure (interval I) ranges from 4 s.l. to at least 20 (average sized males). The space available for the progress of macule  $Cu_1$

depends on the position reached by the center of the corresponding semimacule (this is about s.l. 145, proximal limit, about 155, average, and about 165, distal). Thus when the latter reaches its distal limit (resulting in a narrow interval I, since the præterminal mark cannot wander away beyond a certain limit), the increase in the II-I stretch allows macule  $Cu_1$  a

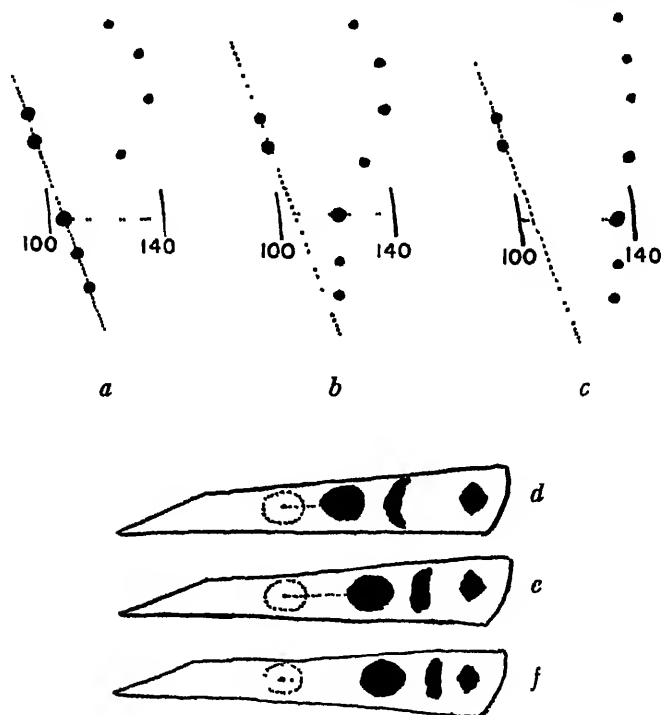


FIG 2 a, b, c, Forewing discal constellation in *Lycarides*, showing proximal, central and distal position of second macule  $Cu_1$ . d, e, f, Cell  $Cu_1$  of forewing, showing relation in position between semimacule (inner part of first macule) and second macule.

greater range (at least 40 s.l.). A terminal extension of the wing even to only 195 in  $Cu_1$  may produce a veritable wilderness for  $Cu_1$  to traverse. These phenomena have great racial importance.

In the hindwing the position of macule  $Cu_1$  varies less con-

spicuously. The same discal arc as in forewing is readily perceived, but the eye sees Rs in a more proximal position in relation to  $M_1$  than  $R_1$  appears in relation to  $M_1$  in the forewing (actually, both Rs and  $R_1$  — especially the latter — have progressed further *distad* from their apices than the corresponding macules  $M_1$  have progressed in their cells). Macules ScIII and ScII at one end and  $Cu_2$  II at the other prolong the discal arc ( $Rs$ ,  $M_1$ ,  $M_2$ ,  $M_3$ ,  $Cu_1$ ) in such a way as to form a horseshoe arrangement around cell RM: this *circumcellular arc* becomes practically a circle in some genera, where the second macule in cell RM (or a third one) is placed basally enough to act as a link. Posteriorly to this, macules  $Cu_2 + 1A$ ,  $2A$  and  $4A$  form a short weak additional arc or *parenthesis* (also a special feature in certain other genera) with its concavity toward the proximal stretch of vein Cu. The radial slant connects macules ScIII, RM,  $Cu_1$  (when lagging) the colon (its  $1A$  part, however, generally “diverges basad”) and the semimacule in  $2A$  by a regular but perfectly imaginary line, traversing the wing and very conspicuous and perfect in butterflies where the anal part of the termen has been stretched tailwise.

When examining *Lycænidæ* patterns for systematic purposes, loose impressionistic descriptions will inevitably result (and I have erred myself in this respect) if the describer does not take into account the actual distances of the macules from the apices of their cells and from the termen, the actual and comparative positions of the split first macules, the extension of the split in comparison to the whole wing, the development of the terminal space, and the relation between the size of the macules and the entire number of scale-lines. I shall limit myself here to a few words regarding the dimensions of macules in this genus.

Divided by three, the sum of scale lines occupied by the three median macules II in a specimen gives pretty exactly the mean size of the whole discal maculation in that specimen. When the relation of this number to the alar expanse in scale-lines (see category I) is around  $1/20$  for each wing, the maculation in the specimen or in the race may be said to be of “average” development in both wings. Below this, it is “reduced”; above, it is “enlarged.” In the forewing macule  $M_1$  is often equal to  $M_2$  but their elongation and direction may be different.  $R_1$  is smaller than  $M_1$  and both tend to be ovoids slanted towards the wing apex, these

two being especially sensitive to the apical pull.  $M_2$  when ovoid, tends to be slanted towards the stem of veins  $R_1$  and  $R_1$  just above the discoidal.  $M_1$  when ovoid and tending towards a proximally pointed cordate shape has its axis directed anteriorly towards the discoidal and posteriorly tornad. The same is true of  $Cu_1$  which is usually the largest in the series and is often very conspicuously elongated (in all these cases, of course, the actual extension and expansion is essentially in a distal direction). Macules  $Cu_2$  and  $1A$  which are often well separate and smaller than  $R_1$  (except when the latter is very much reduced) form together a *colon*, the axis of which is directed either towards the discoidal, and appears more or less in line with the latter's axis, or towards the apex of interspace  $R_1$  and then follows its scale-line (which is most frequently the one traversing the point of forking of veins  $R_1$  and  $R_1$ ), as the discoidal does its own, in which case, since both lie on different sections of their respective scale-lines, discoidal and colon do not appear parallel to each other, the former slanting tornad and the colon remaining "straight," *i.e.*, at right angles to the dorsum. The rare  $R_2$  is smaller than  $Cu_1$  (or  $1A$ ) while the slightly more frequent  $R_3$  is scarcely perceptible to the naked eye. In a general way and disregarding the difference in elongation, the dimensional sequence of macules runs as follows:  $R_1$ ,  $R_2$ ,  $A_1$ ,  $Cu_2$ ,  $R_1$ ,  $M_1$ ,  $M_2$ ,  $M_3$ ,  $Cu_1$ , with the rheniform  $RM$  ( $R + M$ ) slightly broader than colon ( $Cu_2 + 1A$ ).

In the hindwing the macules forming the circumcellular arc are generally subequal, with  $Cu_2$ III and  $M_3$  often tending to be smaller than the rest, while  $R_s$  tends to be slightly enlarged and  $ScII$  is still more so (sometimes vaguely suggesting a very ancient fusion of two spots in adjacent interspaces where the partition has been lost). Thus there is a gradual reduction in size from  $ScII$  to  $M_1$  with  $Cu_1$  subequal to  $M_1$  and  $M_2$ .  $Cu_2$  and  $1A$  are the smallest in series II (and even slightly smaller than  $Cu_2$ III) and are apt to be fused forming an hour glass-shaped or rheniform (distally convex) spot not unlike the discoidal ( $R + M$ ) and of approximately the same size but having a different curvature of axis since they lie upon different sections of their respective scale-lines. The extension of  $2A$  is almost that of  $M_2$  but (transversally to the veins) it is longer and forms a roughly rheniform blotch suggesting a more complete fusion of adjacent macules in  $2A$  and  $3A$  (an extinct vein) than that

of the macules in  $Cu_2II$  and  $1AII$  and often slightly diverted anteriorly and outwardly from the scale-line of its axis. Macule  $M$  in the discoidal cell is intermediate in size between  $ScIII$  and  $Cu_2III$  while the latter is intermediate between  $M$  and  $4A$  which is the smallest of all. In a general way, and taking account of their tendencies, the sequence in size of the macules is as follows:  $4A$ ,  $Cu_2III$ ,  $M$ ,  $M_1$ ,  $ScIII$ ,  $M_1$ ,  $M_2$ ,  $Cu_1$ ,  $Rs$ ,  $ScII$ . The sequence for the rheniform macules (length) is:  $2A$ ,  $Cu_2$  +  $1A$ ,  $RM$ . These sequences are important as they give the order in which macules in both wings tend to disappear in some races. Their reduction (racial) in one wing, however, is not necessarily accompanied by reduction in the macules of the other, nor do the rest of the markings and the general pigmentation always follow suit.

In conclusion a few words may be said concerning the specific repetition, rhythm, scope, and expression of the generic characters supplied by the eight categories discussed. "Repetition" when affecting a conspicuous character or a great number of characters, produces striking resemblances between certain forms (which may be widely allopatric and associated with totally different surroundings) belonging to two or more different species of *Lycæides*, and this kind of resemblance I term *homopsis* since I cannot use "isomorphism," (the mimetic implications of which would be quite irrelevant in the case of this genus), or "parallelism" (which I restrict to resemblances in structural characters), or "analogy" (which is a minor form of homopsis affecting allopatric races of the same species), *inter-specific homopsis* to be precise—for remarkable homoptic forms may be also supplied by *generically* and *tribally* different Lycæinids. "Rhythm" depends on the following: if  $B$ ,  $L$ ,  $P$ ,  $T$  represent in one species of *Lycæides* certain combinations of characters as revealed by definite subspecies, and if in another species the combination  $L$  fails to be represented at all, while on the other hand  $P$  is not represented by a single definite subspecies, but is spread over several, these omissions, gaps, fusions, and syncopatic jerks will produce in one species a variational rhythm different from that of another. "Scope" refers to range of variation in a species in comparison to that of another species and in its approach towards the generic range. A species may set a unique record in one character or category, while lagging



behind in the others, or it may attain a good average in most characters. Finally, "expression" means the slight differences by which even the most strikingly homoptic forms (*i.e.*, belonging to different species) may be distinguished without an examination of the genitalic structure.

*A priori*, I had assumed that in the course of the combination and segregation of generic characters in various racial forms (and this is incidentally the meaning I attach to the term "form") each of the six structurally different groups (*i.e.*, species) of *Lycawides* would be seen to repeat certain stages of the same general (*i.e.*, generic) variation, but would reveal differences in rhythm, scope, and expression, the total of which would produce the synthetic character of one species as differing from the synthetic character of another. This has proved correct insofar as the species are known at present, although certain aspects of rhythm are exaggerated or, inversely, blurred by erratic taxonomy and by the tendency to create a new form not because of its marking some important combinational stage in the morphologic development of the species, but because of its coming from some new locality. New localities, however, are most welcome in themselves, for it should not be forgotten that immense areas, practically all of European and Asiatic Russia, as well as China, and numerous more limited areas in the pale-arctic and nearctic regions are more or less *terra incognita* in regard to these butterflies (although no doubt much precious material from there lies unsorted or misidentified in museums), so that one can still hope to obtain an *agnata* with white underside, a *subsolanus* as blue as *melissa*, and a *melissa* with a heavy vadium.

In delineating in this manner the principles I intend to follow in my subsequent discussion of racial variation in *Lycawides* species, I am guided among other things by the belief that the systematist may fare better when keeping to the all important morphological moment, than when giving comprehensive geographic names (the whole of China, the whole of the Moon) to hypothetical "populations" (a dreadfully misused term — and a hideous word, anyway) on the basis of half a dozen specimens taken by somebody between climb and cloud on some mountain thousands of miles away from the describer's desk.

## SEVERAL NEW SPECIES OF ENDOMYCHIDS (COLEOPTERA) FROM ASIA, AFRICA AND AUSTRALIA

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In the summer of 1939 I received from Dr. Hans Sachtleben of Deutsches Entomologisches Institut a small lot of endomychids with the request that I furnish identifications and describe any new species which might be represented in the material. After the invasion of Poland, I was asked to hold the specimens "until after the war"

Representatives of four new species of endomychids were included in the lot sent by Sachtleben, all four species of more than ordinary interest in that they extend considerably the known ranges of the genera to which they belong. Since the specimens were sent to me unconditionally, I feel free to describe the new species, together with two others from the collection already in my possession. The types of all the species described below are in the author's collection.

***Trycherus vittatus* new name.**

In 1939 (p. 120)<sup>1</sup> I gave the name *Trycherus maculatus* to an unusual species from Nigeria. Erno Csiki of the Hungarian Museum called my attention to M. Pic's (1922 p. 9)<sup>2</sup> prior use of the name. From Pic's description it appears certain that two species are involved and I propose *T. vittatus* to replace *T. maculatus* Strohecker (not of Pic)

***Indalmus hirsutus* n. sp.**

Type, male. Java.

This *Indalmus* has the general aspect of a species of *Pedanus* (Gerstaecker) but the character of its mandibles demands the generic placement given it here.

Head deep red, coarsely and sparsely punctured, with a broad and shallow longitudinal impression along the base of antenna.

<sup>1</sup> Strohecker, H. F. 1939. New Species of Old World Endomychidae. Proc. Royal Ent. Soc. London Series B, 8: 118-120.

<sup>2</sup> Pic, M. 1922. Mélanges Exotico-Entomologiques 35: 32 pp.

Eyes large and coarsely faceted. Antennæ with joint 1 stout, equal in length to joint 3, which is about equal to joints 2 and 4 together, joints 4-6 gradually diminishing in length, joints 6, 7 and 8 of about equal length. Joints 9-11 form a narrow, not much flattened club, which is only a little longer than the preceding three joints together. The mandibles are worn but distinctly prolonged at their tips. The outer lobe of the maxilla is moderately broad and very long, extending beyond the palp and acutely pointed, the inner lobe not more than half the length of the outer and very slender. Prosternal process narrow, not surpassing the front coxæ, which are globose and prominent. Pronotum slightly broader than its middle length, its front angles produced to the eyes and rounded. From the front angles the sides of the pronotum widen very slightly to their middle, then are constricted and run straight back to the slightly acute but not produced hind angles. Side margins narrow. Lateral sulci deeply impressed, a little divergent, ending behind the middle of pronotal disc. Transverse sulcus deep, almost straight. Surface of pronotum black, the edges reddish, clothed with a fine, recumbent, gray pubescence. Scutellum transverse, rounded behind. Elytra at shoulders a little broader than the pronotum, widening posteriorly. Sutural stria fine. Each elytron bears two transverse, reddish-yellow marks; the first just behind the shoulder, beginning at the side, then a little constricted in the longitude of the umbo, thence expanding rapidly posteriorly so that the spot is roughly foot-shaped. The posterior spot is equally removed from sutural and lateral margins. It is produced anteriorly into two broad, blunt processes and posteriorly into two equally broad but longer processes of which the inner is the longer and more pointed. The elytra, like the pronotum, are clothed with a fine, sparse, gray pubescence. The under surface is red except for the mesosternum, which is black. Legs black.

The single specimen available is a male as revealed by dissection of the genitalia. The only external feature which seems to be of accessory sexual nature is a small curvature of the middle tibiæ in their distal third. The last ventral segment is lightly rounded and shows no special characters. The last dorsal segment is also rounded and entire. Length 6 mm.

**Meilichius æneoniger** n. sp.

Type (sex undetermined). Nilgiri Hills, India.

A small, highly convex, glabrous and shining insect. Antennæ reddish-brown with joints 9 and 10 and the base of 11 infusate. Each of the first seven joints is about twice as long

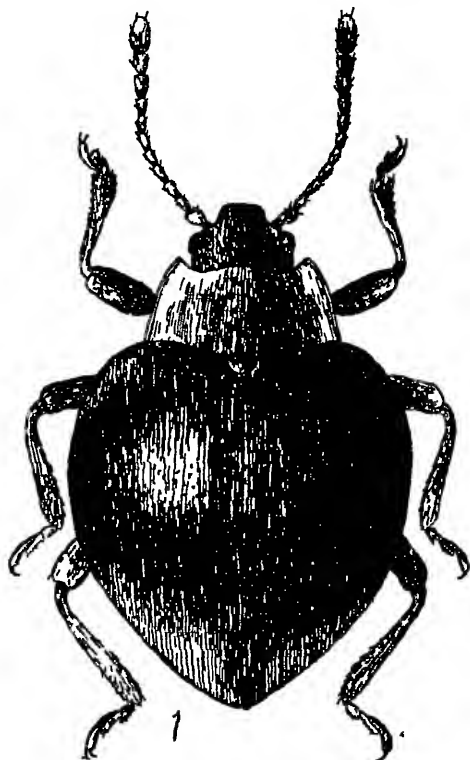


Fig. 1 *Meilichius æneoniger* n. sp., type

as wide, joint 8 only a little longer than broad. Joint 11 almost equal to 9 and 10 together. Pronotum more than twice as broad as long, lightly convex, black with bronze luster, the margins pale. The pale area along the margin is expanded a little at the front angles and more decidedly at the hind angles. Surface of pronotum finely and sparsely punctured at middle, no punctures evident at the sides. Head bronze-black, clypeus, labrum and

palps reddish. The vertex is rather coarsely and thickly punctured and beset with hairs. Elytra strongly elevated and rounded, both in longitudinal and transverse directions, their side margins invisible from above, finely and sparsely punctured, rather strongly shining. The elytra are bronze-black except for the scapular and apical margins, which are pale. Legs reddish with exception of distal portions of the femora, which are fuscous. Under surface, including elytral epipleuræ, red-brown, the metasternum and median area of first abdominal segment black. Prosternal process exceptionally broad. Length  $3\frac{1}{2}$  mm.

*Milichius*, the transliteration of Gemminger and Harold, has been in vogue for this genus but the rules of priority would demand retention of the name as proposed by Gerstaecker. The occurrence of *Mcilichius* in India, while not surprising, is noted here for the first time. Arrow did not find any specimens of the genus in the material studied by him and reported in the "Fauna of British India (Coleoptera, Erotylidæ, Languriidæ, Endomychidæ)."

In addition to the type there is another specimen of undetermined sex bearing the same data which is designated paratype.

***Ectomychus africanus* n. sp.**

Type, male. "S. O. Kamerun, Lolodorf, L. Conradt 95."

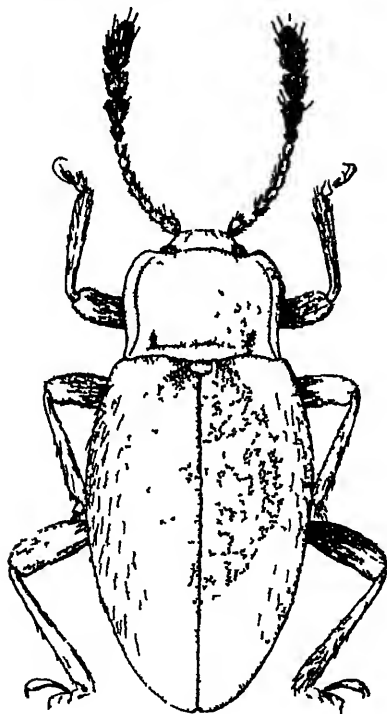
A small, uniformly reddish-yellow insect clothed with yellow, semi-erect hairs of moderate length. Its features are typical for the genus but the second tarsal joint is narrow and more like *Stenotarsus* than the genotype of *Ectomychus*, *E. basalis* Gorham. Head and thorax finely, evenly and rather closely punctured. The raised border of the pronotum is sharply defined internally and is narrowed a little posteriorly. The lateral sulci of the pronotum are almost straight, very slightly convergent anteriorly, not reaching to middle of disc. Pronotum sinuate at base, without transverse sulcus. Scutellum broadly triangular. Elytra together distinctly longer than broad, finely, evenly and densely punctured. Pro-, meso- and metasternum reddish, abdomen yellow and clothed with a long, sparse pubescence. The middle of the first abdominal segment bears a dense tuft of hairs, possibly a sexual feature. Antennæ one-third the length of body, yellow with the three club joints dusky. The ninth and tenth joints are angularly produced internally and all the

club joints are much broader than those of the funicle. The club closely approximates the funicle in length. The trochanter of the hind leg is angulate internally. Length 2.3 mm.

*Danae nigrosignata* n. sp.

Type, male. S. E. Java

In size, form and coloration (except elytra) this species is similar to the North American *D. testacea* (Ziegler). Antennae



2

FIG. 2. *Danae nigrosignata* n. sp., type

about  $\frac{2}{3}$  as long as body, joints 2 and 4-8 nearly equal, joint 3 a little longer than 2, joints 9 and 10 obconical, a little flattened, each about as long as joints 7 and 8 together; joint 11  $\frac{2}{3}$  or  $\frac{3}{4}$  as long as 9 and 10 together. The first seven joints

of the antennæ red, joint 8 and the club black. Eyes coarsely granulate. Pronotum with the front angles obtuse, its sides evenly rounded, slightly constricted behind the middle, the hind angles acute and slightly divergent. Margin of pronotum moderately broad, very low. Disc of pronotum strongly convex, lateral sulci obsolete, basal foveæ deep, basal transverse sulcus broad and shallow. Elytra long oval, their sides evenly rounded, umbones perceptible but feebly elevated. Scutellum transversely oval. The most distinctive feature of the insect is a large, oval, black patch upon the elytra, in which feature it resembles *D. atronotata* Pic (from description) but the present species lacks pronotal markings. The prosternum is rather broad between the front coxæ, prolonged posteriorly beyond them as in *D. testacea* (Ziegler). The pronotum is sparsely and very finely punctured, the elytral punctures are sparsely placed and a little coarser than those of the pronotum. The specimen was probably pubescent over its entire surface but now shows a sparse covering of hair only at the sides of the pronotum and elytra. The under surface has a similar sparse pubescence except the central area of the metasternum. Length 3 mm.

From the exposed sixth ventral abdominal segment I think the specimen is a male but there are no sexual features apparent in the antennæ or legs.

*Saula serraticollis* n. sp.

Type, male. "S. O. Kamerun, Lolodorf, L. Conradt 95."

Reddish-brown with the exception of the eyes and last four antennal joints, which are black. Head with scattered, fine punctures. Eyes prominent, coarsely granulate. Head behind the eyes narrowed into a short neck. Antennæ surpassing shoulders of elytra by the length of last two joints. Joints 1-6 reddish-yellow, 7 dusky, 8-11 shining black, joints 9-11 forming a loose-jointed club. Joint 9 longer than broad; joint 10 a little broader than 9; joint 11 oval, its apex evenly rounded. Thorax broader than long, its front angles obtusely rounded. From the front angles the sides of the pronotum are expanded for a third of their length, then evenly but abruptly constricted, expanded again at the hind angles, which are acute and slightly produced. Transverse, basal sulcus almost straight, deeply impressed, lateral sulci absent. The entire surface of the pronotum is thickly, coarsely, subrugosely punctured. There is, on either

side of the pronotum behind the middle, a broad, transverse impression. Elytra twice as long as their breadth together, apices separately rounded, surface finely and evenly punctate. Scutellum broadly triangular.

The occurrence of *Saula* and *Ectomychus* in west Africa is unexpected and one is inclined to question the accuracy of the

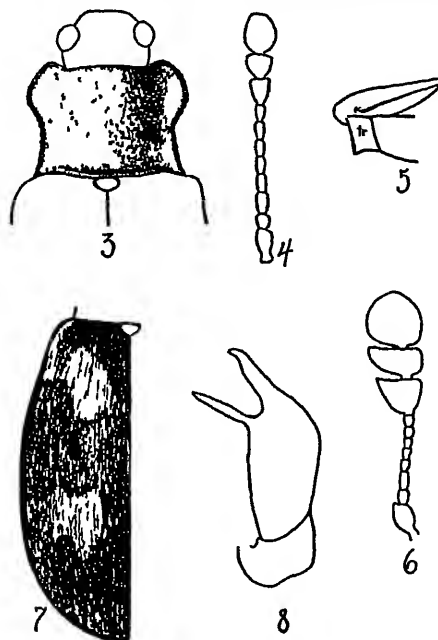


Fig 3 *Saula serraticollis* n sp, pronotum of type Fig 4 *Saula serraticollis* n sp, antenna of type Fig 5 *Ectomychus africanus* n sp, hind trochanter of type Fig 6 *Ectomychus africanus* n sp, antenna of type Fig 7 *Indalmus hirsutus* n sp, clytron of type Fig 8 *Indalmus hirsutus* n sp, aedeagus of type

attached labels. Particularly in the case of *Saula serraticollis*, however, the differences between it and the known species (all Asiatic) seem to indicate a long separation. The rugosity of the pronotal disc, and the constriction and fine serrations of the pronotal margins are all features peculiar to it. On the other hand there are apparent no characters worth generic recognition. The notable expansion of the second tarsal joint (in the Asiatic species of *Saula*) is not shown by the present species. Length 3.5 mm.



*Stenatarsus blackburni* n. sp

Type, male. New South Wales, Australia

Large for the genus, long oval in outline, decidedly convex, pubescent. Color purplish-brown with the edges of the pronotum lighter and with the humeri and a median spot on each elytron yellow. Labrum very short and almost truncate in front, clypeus transversely rectangular, the suture deeply impressed. Antennæ less than half the length of body, moderately stout; joint 1 abruptly expanded from the base, joint 2 transverse, joints 3, 4, 6 and 8 about as broad as long, 5 and 7 a little longer than broad, 9 evenly expanded from base to apex and about as broad as long, 10 somewhat transverse but a little longer than 9, joint 11 twice as long as and scarcely broader than 10, obliquely truncate at tip. Pronotum transverse, its elevated margin gradually narrowed from front to base, its sides parallel from base to middle then arcuately rounded to the obtuse front angles. Hind angles right. Base of pronotum broadly convex, transverse sulcus deeply impressed, lateral sulci obsolete but the basal foveæ very deep. Just behind the deep fovea the base of the pronotum is elevated into a blunt tooth. Pronotal punctures fine, shallow and sparse on the disc, indistinct at the sides. Elytra with the humeri prominent and yellow in color. On each elytron there is a broad, black band, which begins at the base and extends posteriorly beyond the middle, expanding behind the umbo to approach the lateral margin. Near the inner margin of this black band and a little in front of the middle of the elytron there is a yellow spot, edged with red. The inner margin of the black band is interrupted for the length of the yellow spot. The elytra are densely and finely punctured with seven rows of larger punctures which end behind the middle, the three rows on the disc indistinct, those on the sides more conspicuous and with larger punctures. Length 7 mm.

Very close to *St. ursinus* Gerstæcker in structure but differing much in coloration. The fifth and seventh joints of the antennæ are relatively longer than in *ursinus*. The name given the species is that of the Reverend T. Blackburn.

AN AMMOBÆNETES FROM NEVADA  
(ORTHOPTERA; GRILLACRIDIDÆ)BY H. F. STROHECKER  
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A few years ago Ira LaRivers of Reno, Nevada sent me, with other Orthoptera, a fine series<sup>1</sup> of an undescribed species of gryllacridid. The specimens show the trimerous front and hind tarsi and crowded, long spurs on the hind tibiæ characteristic of *Ammobænetes* Hubbell (1936). I have given to the species the name of its discoverer, who has made careful studies of Nevada insects. The use of *spur* and *calcar* below is that of Hubbell (1936, p. 16).

*Ammobænetes lariversi* n. sp.

Type, male. Sand Spring Dune, Churchill County, Nevada, July 5, 1941.

Considerably smaller than the only other described species, *A. phrixocnemoides* (Caudell). Front with a low, broad carina; eyes moderate in size, rather protuberant. Front coxa with a small, lateral spine. All the femora are unarmed. Hind femur stout, tapering rapidly at its apical third. Front tibia somewhat spindle-shaped, convex above, below convex on basal half, plane on apical half. The armament of the front tibia consists of a pair of dorsal calcars (the anterior 2/3, the posterior 3/4 as long as first tarsal joint), a pair of ventral calcars (anterior equal to, posterior much longer than, first tarsal joint), three short, slender spurs on the ventrocephalic carina and four large, blade-like spurs on the ventrocaudal carina. Claws of front tarsus asymmetric, the anterior longer. Middle tibia with four slender spurs on each dorsal edge, four slender spurs on ventrocephalic edge and one on ventrocaudal edge. The left middle tibia has three ventrocephalic and one ventrocaudal spur. The calcars of the middle tibia are proportioned as those of the front tibia but are much smaller. Claws of middle tarsus symmetrical, about equal to the shorter claw of front tarsus. Hind tibia

<sup>1</sup>The specimens came to me in alcohol and were hardened in xylol before pinning

broadest at its apical third, thence obliquely narrowed to apex, plane above. The dorsal surface of the tibia bears two small spurs on each margin, between which are small denticulations, and seven pairs of very long spurs (including dorsal calcaria) on its apical third. Of these long spurs the more distal are subspatulate at the apex and those of the posterior or inner series

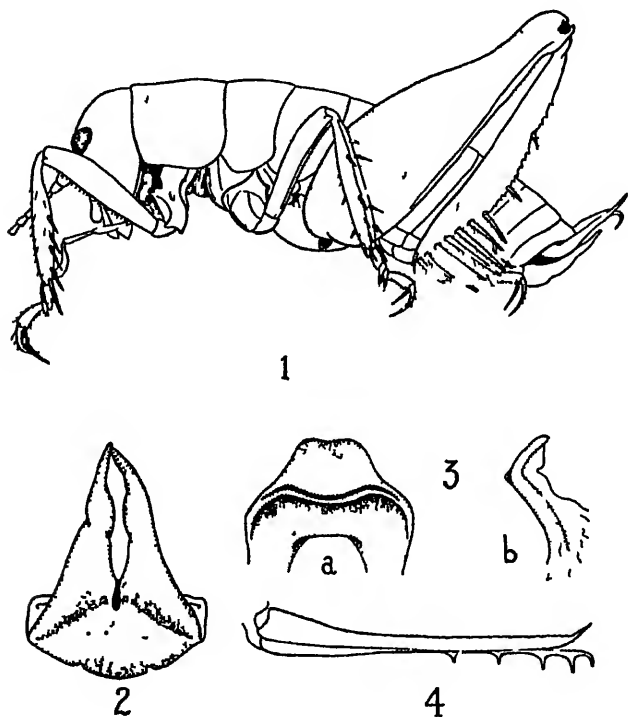


Fig 1 *Immobanetes luvvysi* Strohecker. Type  $\times 10$ . Fig 2 Subgenital plate of type. Fig 3 Pseudosternite of paratype (a) posterior, (b) right lateral view. Fig 4 Ovipositor of allotype.

are longer than those of the anterior. Ventral calcaria of hind tibia short and slender. First joint of hind tarsus longer than the second and third together. Claws symmetrical, longer than claws of middle tarsus. Subgenital plate membranous, produced as two long, tapering processes. The color is pallid yellow-white with a slate colored band between the eyes on the front. The

sides of the head, thorax, first few abdominal segments, hind femur and tibia are marked irregularly with similar color.

Length of pronotum 2.6 mm.; of hind femur 8.7 mm

Allotype: female. Data same as for type.

Similar to the type except in terminal abdominal structures and the following features: the left, front tibia has four ventrocephalic spurs, middle tibiae each with three ventrocephalic and no ventrocaudal spurs. Subgenital plate entire, arcuately rounded. Ovipositor bulbous at base, rapidly narrowed in its proximal third, thence almost parallel. The dorsal margin of the upper valve is feebly crenulate in its distal half. The apex of the upper valve is upturned (about 30° from horizontal) and aciculate. The lower valve is equipped with four, widely spaced, slender teeth and a decurved, apical hook. Length of pronotum 3 mm., of hind femur 9.5 mm.; of ovipositor 7.2 mm.

The series includes, besides the type and allotype, twenty males and forty-two females, all of which are designated paratypes. The entire lot was taken at Sand Spring Dune. Among the male specimens the minimum pronotal length (four specimens) is 2.5 mm., the maximum (one specimen) 3 mm. The other sixteen specimens all show a pronotal length 2.6–2.8 mm. The extremes of hind femur length are 8–10 mm., but sixteen specimens fall between 8.5–9.5 mm. Pronotal extremes among the females are 2.8–3.6 mm.; thirty-six of the specimens fall within the limits 3.0–3.5 mm. Similar data for the hind femur are: extremes 8.8–11 mm.; with thirty-five specimens within the limits 9.5–10.5 mm. For the ovipositor the extremes are 6.6–8.3 mm. All but three specimens fall within the limits 7.0–8.0 mm.

The number of ventrocaudal spurs on the front tibia is a fairly constant feature, probably generic rather than specific. Five specimens show five ventrocaudal spurs on one front tibia, one has five spurs on each front tibia while one specimen has only three such spurs on one of its front tibiae. The dorsal armament of the middle tibiae is also rather constant. Four specimens have five spurs in the dorsocephalic series while three specimens have five spurs in the dorsocaudal series. None has a 5–5 armament and in all cases the aberration is unilateral. It is not correlated with sex.

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## NEW NEOTROPICAL PHORIDÆ

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Most of the material dealt with in the present communication was contained in a collection belonging to the Entomological Department of Cornell University. This was sent to me for identification and the holotypes of the new species have been returned to the Cornell museum.

Several of the species were collected on the western slope of the Andes in central Peru by Professor J. C. Bradley when he visited the region with an expedition from Cornell University in 1920. Others were obtained during the same year, on the very interesting Chiloë Island, which lies in the Pacific Ocean, just off the Chilean coast.

One species collected some years ago in Cuba by the writer is included also.

*Diploneura* Lioy*Diploneura (Dohrniphora) pyricornis* sp. nov.

♂. Length 2.5 mm. Brownish testaceous; front black above, shading to pale yellowish brown below at the frontal margin; abdomen honey yellow with the extreme sides of the third and fourth tergites black; antennæ very pale, clear yellow; palpi and legs concolorous with the body. Front fully one-third wider than high, its surface smooth and noticeably shining but not punctate. Postantennal bristles very close together; lower transverse row of four bristles straight, the median bristles equidistant from one another and from the eye margin, the lateral bristles removed from the eye by a short distance; upper frontal row of four with the median pair very slightly higher than the lateral ones, each directly above the lower median bristles, but the lateral ones are very close to the eye-margin; ocellar row of four bristles, with the median ones much nearer to one another than to the lateral bristles. Ocelli in a very low triangle or curved line. Antennæ pyriform or conical, really more or less crescent-shaped, as the edge next the face is con-

cave and the outer one convex, about twice as long as wide; apex pointed and extending well beyond the lowest lateral frontal bristle, not noticeably enlarged. Arista clearly sub-apical, considerably thickened at the base, not much longer than the antenna. Postocular cilia small, the cheeks each with a very strong bristle; palpi not enlarged, densely beset with strong bristles below, near to, and at, the apex. Thorax very stout, the mesonotum very broad and weakly convex, considerably broader than long; its surface shining, with very sparse black hairs; one pair of widely separated dorsocentral bristles. Scutellum very short, more than three times as wide as long; with four marginal bristles of equal length, the median ones very widely separated. Propleura with a large bristle below the spiracle. Mesopleura entirely bare. Abdomen with the sixth tergite lengthened, its upper surface dull, without hairs except for four bristly ones near apex. Hypopygium very inconspicuous, its lamella strongly bristly. Front tibia with the usual four bristles, placed at the basal third, middle, apical third and near apex on the anterior surface, their tarsi simple, moderately slender. Middle tibiae with a hair-seam that extends to its middle as a very thin line; apical half of the tibia with five or six indistinct transverse comb-like rows of minute, white bristles; a pair of bristles, one on each side of the seam, near the base and an anteroventral one near the apex. Hind tibiae with a single dorsal hairseam, weaker toward the apex, and a similar weak series of comb-like bristles, with a series of four rather small bristles on the anterior face between the basal and apical fourth. Hind femora with a series of rather conspicuous curved hairs on the apical third of the lower edge. Wings slightly yellowish; veins brown, the third vein paler. Costa extending somewhat beyond the middle of the wing, its bristles short and closely placed; first section of costa two and one-half times as long as the second and third together; third less than half as long as the second (25:7:3); fork of third vein very acute; fourth vein weakly curved; fifth nearly straight; sixth very weakly bisinuate. Halteres yellow.

Type from "Upper Reaches" of Pachitea, Peru, July 21, 1920, Cornell University Expedition. Type in the Cornell Collection, a second male from the same locality has the abdomen darker above, with the third, and fourth tergites successively

more infuscated and with sharply pale bands along their posterior margins.

This species resembles *D. antecrospinalis* Borgm., but differs in the wider front and conspicuously elongated, pointed antennae of the male.

*Diploneura (Dohrniphora) opposita* Borgmeier.

Arch. Mus. Nac., Rio de Janeiro, vol. 25, p. 107 (1925)

A single female from La Sombre, Peru, August 22, 1920 (Cornell Univ. Exped.), agrees closely with Borgmeier's description of this species which is based on material from Petropolis, Brazil.

*Diploneura (Dohrniphora) monticola* Borgmeier.

Arch. Mus. Nac., Rio de Janeiro, vol. 25, p. 103 (1925)

One female from Bello Horizonte, Minas Geraes, Brazil, November 1919 (Cornell Univ. Exped.).

*Conicera* Meigen

*Conicera chiloënsis* sp. nov.

♂. Length 1.4 mm. Dark brown or piceous, the abdomen black. Pleurae lighter, distinctly brown above and yellowish brown below. Legs quite uniformly dark brown. Wings slightly infuscated on the apical half; veins dark brown. Front considerably more than twice as broad as long, with only ten bristles, as the postantennals and lower laterals are absent. Antial bristles almost equidistant from one another and the eye-margin, slightly nearer to the latter; curved medially so that they cross one another, directed almost horizontally forward, as strong as the other frontal bristles. Four bristles in the lower frontal line placed near to the lower frontal margin and forming a transverse line that is slightly concave; the bristles equidistant, with the lateral one barely separated from the eye-margin. Ocellar row of four equidistant bristles. Surface of front subshining, slightly pollinose, without median groove. Third antennal joint broad at base, conical, with the upper surface concave so that the tip is crescent-shaped, not extending quite to the level of the top of the eye; arista long, pubescent, thickened basally. Eyes microscopically hairy, cheeks each with three rather weak bris-



gles; postocular cilia strong. Palpi small, with the usual bristles present, but of small size. Mesonotum rather dull, clothed with well developed sparse hairs; much narrowed behind, one pair of long, but not stout, dorsocentral bristles. Scutellum with two very long bristles. Mesopleura entirely bare. Surface of abdomen dull, the hypopygium shining, pollinose along the lower part of the sides. Wings hyaline, with a slight brownish tinge at the base and with distinct infuscation apically. Costa extending to .45 of the wing length, first section more than twice as long as the second (27:12). Costal cilia long, rather closely placed, fully as long as the width of the costal cell, the cilia of the upper series not extending beyond the tip of the first vein. Third vein simple; no indication of a fork. Legs rather slender, the tibiae all clothed with minute bristly hairs, front tibiae with a small, but distinct bristle on the anterior side at the basal third, middle tibiae with an anterior bristle at the basal fifth and a dorsal one barely farther from the base, with a third anterior bristle just before apex. Hind tibiae with four bristles, one posterodorsal, at basal fourth and another at apical third, one anterodorsal at basal fifth and another before the middle; in addition to these there is a dorsal bristle just before tip. Halteres piceous.

Type ♂ from Ancud, Chiloe Island, Chile, April 2-7, 1920 (Cornell Univ. Expedition).

This is a very unusual species, but agrees rather closely with two described by Schmitz from Patagonia. These he has placed in a separate group on account of the complete absence of post-antennal and lower lateral bristles, long decussate antial bristles and extensive bristling of the hind tibiae. The present species differs strikingly by the longer second section of the costa which is much longer in the male than in males of the Patagonian forms.

#### *Megaselia Rondani*

##### *Megaselia* (*sens. str.*) *andicola* sp. nov.

♂. Length 1.4 mm. Black; lower portions of pleurae piceous or very dark brown; antennae piceous, with the inner surface of the third joint yellowish; palpi pale yellow; legs testaceous, although appearing darker on account of the black hairy covering, coxae darker basally. Halteres pale yellowish brown. Wings hyaline, the heavy veins rather pale brownish. Front slightly,

but distinctly wider than high; four postantennal bristles, the lower pair not much shorter than the upper; antial bristles close to the lowest laterals, scarcely below them but much farther from the eye-margin; lower transverse row of four equidistant bristles slight bowed downwards medially; ocellar row as usual, large like the other frontal bristles. Ocellar tubercle and median frontal line well defined, the surface of the front sub-shining, distinctly white pollinose. Postocular cilia stout, of moderate length; cheek just below the eye with two stout downwardly directed bristles, three above these toward the antennæ small and delicate. Palpi small, flat, with moderately long bristles below toward apex. Third antennal joint large, but not noticeably swollen, rounded, the arista one-half longer than the front, with short pubescence. Proboscis very short, stout, bluntly pointed at its tip. Mesonotum shining, with fine pubescence. One pair of dorsocentral bristles set very close to the scutellar suture. Scutellum narrow, triangular, with two bristles. Pleuræ shining, but noticeably pollinose above, entirely without hairs or bristles, except two small bristles at the lower anterior corner of the propleura. Abdomen dull black, segments of approximately equal length, with a few weak, bristly hairs at the sides and a marginal row on the posterior margin of the sixth tergite. Hypopygium simple, cylindrical, appearing quadrate or somewhat tapering posteriorly in lateral view. Legs slender, including the hind femora which are three times as long as broad. Front tarsi slender. Middle tibiæ with the dorsal black line distinct at apex, with about eight weak setulæ just inside the dorsal line. Posterior femora slender, exactly three times as long as their greatest length. Dorsal hair-line of hind tibiæ complete, straight except for a slight angulation very near to the base, with a single postero-dorsal series of eight bristles, each about the width of the tibia. All tarsi very slender. Wings narrow, costa less than half the wing-length (70:31), its bristles delicate, moderately long and rather closely placed; first section of costa as long as the other two sections together; second section three times the length of the third (28:21:7). Third vein absolutely straight except beyond the very narrow cell formed by the very oblique second vein; fourth vein strongly curved at base, but nearly straight beyond; fifth vein curved near base, very slightly sinuous beyond; sixth sinuous; seventh practically straight.

One male from Matucana, Peru, May 27, 1929 (Cornell University Expedition).

Among the Neotropical species this is related to *M. obscurata* Enderlein to which it will run in Borgmeier's key (Rev. Entom., vol. 5, p. 441) but differs in the frontal chaetotaxy. In Borgmeier's earlier paper (Arch. Mus. Nac. Buenos Aires, vol 25, p. 139) it falls near *M. stephanoides* Borgm. and *M. concava* Borgm., from either of which it may be distinguished by the lengths of the costal divisions and it lacks the bristles present on the sixth abdominal tergite in *M. stephanoides*, although this may be a secondary sexual character. It resembles also *M. opilionidis* Borgmeier, but the ovipositor is not chitinized and there are only two scutellar bristles.

*Megaselia (sens str) rimacensis* sp. nov.

♀. Length 1.7 mm Front and abdomen black; thorax above dark fuscous; pleuræ lighter brown below; front legs and all coxæ pale yellowish; four hind legs brownish yellow with the hind femora indistinctly blackened at tips Antennæ black; yellow-brown at the base of the third joint; palpi light brown. Wings hyaline, the heavy veins light fuscous; halteres honey yellow. Front subshining, not polished, with a deep median groove. Four postantennal bristles, the lower pair half as long as the upper ones and very much more slender; antial bristles inserted at the same level as the lowest lateral bristles and separated from them by less than one-third the distance to the upper postantennals; middle row of four bristles equidistant, curved downwards medially, the median bristles midway between the ocelli and postantennal bristles; third joint of antennæ much enlarged and flattened, at least as broad as two-thirds the height of the front Palpi slightly flattened, with five or six rather small bristles. Mesonotum strongly convex, shining, one pair of dorsocentral bristles very close to the semi-circular scutellum, which bears one pair of widely separated long bristles and a single pair of minute hairs Propleura with several bristles above and below, near the posterior margin. Mesopleura entirely bare, slightly roughened and dull on its upper portion behind. Surface of abdomen opaque above, second to fifth segments slightly decreasing in length; sides of second tergite with half a dozen bristly hairs at each side; all the tergites with a series of minute, bristly hairs along the

posterior margin, noticeably longer on the more apical tergites. Hypopygium small, its surface pruinose; rounded, with scattered, stiff, bristly hairs below and apically above; apical lamella pale yellow, with very weak scattered hairs. Legs slender, except the front tarsi which are comparatively stout although not really thickened. Hair seam on middle tibiae distinct only on basal half; the row of setulae extremely delicate. Hair seam of hind tibiae complete, straight, the setulae distinct, but very weak and closely placed. Costal vein slightly less than one-half the wing length (46:100); costal cilia moderately long, about equalling the length of the third section of the costa. First section of costa slightly more than twice as long as the second; third half as long as the second (35:17:9); fourth vein weakly curved, fourth and fifth each feebly bisinuate; seventh distinct, slightly curved.

Type and one paratype from Matucana, Peru, May 27, 1920. Matucana is in the valley of the Rio Rimac, about 4000 feet above sea level. Type in the collection of Cornell University.

This species is from the same locality as *M. andicola*, but is not very closely related. The tibial setulae are minute and the wing venation is very different. In Borgmeier's key (Arch. Mus. Nac. Rio de Janeiro, vol. 25, p. 139, 1925) it runs to *M. stephanoides* Borgm. from which it differs by color and the much longer third costal section, while the entire costa is less than half the length of the wing. Among Enderlein's species as tabulated by Borgmeier, it resembles *M. obscurata* and related species, from which it differs at once by the more nearly equal first and second sections of the costa.

*Megaselia (s. str.) cavita* sp. nov.

♀. Length 2.2 mm. Head and thorax yellow, the ocellar triangle black and the front strongly infuscated, except the sides and the front margin. Abdomen black, suffused with fulvous over the medial portions of the second, third and fourth tergites; sixth tergite with a similar large pale area at each side. Legs and hypopygial projection testaceous. Wings faintly brownish, with strong dark venation. Halteres piceous. Front slightly, but distinctly wider than long, its bristles stout, but not especially long, surface rather shining; ocellar tubercle and median groove well developed. Two large postantennal bristles placed very close together; lower pair absent. Antial bristles on the

lower margin of the front, twice as far from the eye as from the postantennals and dividing the margin into three equal parts. Lowest lateral bristle far above the antial and much farther from the eye than usual. Upper transverse row of four bristles equidistant, forming a line that curves downward medially. Antennæ greatly enlarged, oval or slightly pyriform, as long as half the eye-height, considerably longer than wide; arista stout, as long as the head-height. Palpi small, flattened, with five moderately long bristles along the apical half of their outer edge. Two large downwardly directed bristles on the cheek, but none above these in front. Postocular cilia of moderate size. Mesonotum rather shining, with one pair of dorsocentral bristles. Scutellum broad, fully twice as wide as long, the posterior margin gently arcuate; four equal scutellar bristles. Propleura with several weak bristly hairs, next to the front coxa, and a few similar ones at the upper angle. Mesopleura entirely bare and shining above. Abdomen entirely devoid of any noticeable bristly hairs above, except for a few exceedingly minute ones at the sides of the second tergite, and a weak fringe at tips of the sixth and seventh tergites. Second to fifth tergites of about equal length; sixth noticeably longer. Hypopygium small, retracted, its median projection with unusually weak bristly hairs. Legs slender, including the front tarsi. Middle tibiæ with a very feeble dorsal line and a corresponding weak series of postero-dorsal setulæ; hind tibiæ with dorsal hair-line and a postero-dorsal series of 10-12 weak setulæ the longest of which are much shorter than the width of the tibia; hind femora slender, with no noticeable bristly hairs below. Costa reaching beyond the middle of the wing (100.57), its bristles closely placed, very short, not much longer than the width of the costal vein; first section of costa one-half longer than the second; third very short (48:32:5), cell formed by the second vein very small and narrowly ovate. Third vein widely separated from the costa at its middle as it is curved posteriorly and the first section of the costa is noticeably curved forward. Fourth vein evenly arcuate, not recurved at either base or apex; fifth vein sinuate; sixth very slightly so; seventh strong. Base of the third vein without bristles.

Type from the San Juan Mts., near Cienfuegos, Cuba, Jan. 1927 (C. T. and B. B. Brues).

*M. cavita* is conspicuous by the much enlarged antennæ of the

male which are longer than wide, differing in this respect from *M. amplipennis* Borgm. in which they are widened. From *M. furcella* End., also with enlarged antennæ, it differs by the nearly quadrate front and in the disposition of the frontal bristles. It resembles several other Neotropical species in the long costa, short fringe and the presence of four scutellar bristles. Among these it differs from *M. opilionidis* Borgm. by the bristling of the front; from *M. brasiliensis* Borgm. by the large antennæ; from *M. membranosa* Borgm. by the different wing venation; from *M. parvitergata* Borgm. by the absence of the lower pair of postantennal bristles. From the common *N. xanthina* Speiser and *M. scalaris* it is readily distinguished by the enlarged antennæ of the male.

*Megaselia* (s. str.) *femoralis* Enderlein

I collected a large series, representing both sexes in the San Juan Mountains in southern Cuba. Described from Brazil, *M. femoralis* has previously been taken in Panama and as far north as Costa Rica. The present record shows that it extends also into the West Indies. In some Cuban specimens the thorax is quite brownish above and the abdomen is very pale dorsally at the base, with suffused brown on the third to fifth tergites. The front may be brownish below, but always shows the highly polished steel-blue color above.

*Megaselia* (*Aphiochæta*) *asthenichæta* sp. nov.

♀. Length 1.5 mm. Black or very dark piceous, the anterior corners of the mesonotum and the anterior part of the propleura reddish brown; palpi and antennæ entirely black; mesopleura and metapleura irregularly stained with reddish brown; wings slightly, but distinctly infuscated; veins very dark brown. Legs strongly infuscated, especially the middle legs which have the extreme tip of the femora and tibiæ pale; trochanter testaceous; front tibiæ and base of hind femora yellowish testaceous. Halteres very light brown. Front narrow, one-fifth higher than wide, with distinct ocellar tubercle and unusually deep median frontal groove. Four postantennal bristles, the lower pair close together as usual; upper and stronger pair widely separated, as far from the median line as from the eye-margin, placed slightly higher than the antial bristles which are directly below the lowest lateral bristles, next to the eye and at the lateral angle

of the front; middle transverse row of four equidistant bristles forming a practically straight line, its lateral bristles placed midway between the lower and upper lateral bristles. Surface of front slightly shining, but not polished, sparsely clothed with short hairs, the frontal bristles large and stout. Antennæ small, with long, pubescent arista. Palpi very small, with three or four large bristles below. Cheeks each with three stout downwardly directed bristles below and a series of smaller ones extending upward to the antennæ. Postocular cilia of normal length. Mesonotum narrow, its surface shining, clothed with dense short hairs; one pair of dorsocentral bristles. Scutellum subtriangular, with four well developed bristles. Propleura with two stout bristles at the lower anterior angle and one just below the spiracle. Mesopleura with a patch of hairs above and a conspicuous bristle of moderate size, clearly smaller than the frontal bristles; also with a smaller bristle just below the edge of the mesonotum. Abdomen narrowed apically, none of the tergites lengthened, without any bristly hairs above except just before the small, retracted hypopygium; sides of abdomen with sparse bristly hairs, larger on the second segment. Front tibiæ bristly on the dorsal surface, but without any distinct linear series; front tarsi stout, but not conspicuously thickened. Middle tibiæ with a dorsal hair-seam extending almost to the apex, and a posterodorsal series of setulæ, about eight in number, each approximately as long as the width of the tibia; a few antero-dorsal setulæ for the basal half. Hind tibiæ with complete dorsal hair-seam and a series about eleven postero-dorsal setulæ, these large and stout, as long as the width of the tibia, except the several ones at the base which are very small and weak; no antero-dorsal setulæ. Wings narrow, nearly three times as long as wide (64:23); costal vein long, extending beyond the middle of the wing (55:100); first division nearly as long as the second and third together, third more than one-third as long as the second (30:24:9). Fringe moderately long, the bristles about equal to the second vein in length. Fourth vein feebly, evenly curved, except for a sharper bend near the base. Fifth vein sinuous, more distinctly bent just before the middle; sixth sinuous; seventh very slightly so. Third vein with a single bristle at the extreme base.

Type from Puerto Bermudez, Rio Pichla, Peru, July 18-19, 1920 (Cornell University Expedition).

This species differs from most of the Neotropical species of the subgenus *Aphiocharta* by the presence of four scutellar bristles in combination with a large bristle on the mesopleura. It resembles *M. luteicauda* Borgm. and *M. pteryacantha* Borgm. in having a bristle at the base of the third vein, but differs by the black palpi, entirely black abdomen and narrower front. From *M. pilipleura* Borgm. it differs in color, size and frontal chætotaxy. From *M. angustifurcata* it differs particularly in wing venation and also by the black antennæ and palpi. In general habitus *M. asthenichæta* resembles *M. minor* Zett. although structurally very different.



NOTE ON THE HABITS OF *OSMIA GEORGICA*  
CRESSON<sup>1</sup> AS ASCERTAINED BY THE  
GLASS-TUBE METHOD

By CARL G. HARTMAN, assisted by  
PAUL and PHILIP HARTMAN and CARL RETTENMEYER

In the summer of 1940, at "Holiday Heights" in Bethlehem, Conn., while amateurishly taking snap-shots and motion pictures of solitary bees and wasps, we were favored by visits of any number of individuals of *Osmia georgica* females to our glass-tube domiciles. We were able to observe, through the transparent walls of the tubes, the domestic activities of the bee, including the manner of making "bee-bread" and laying the egg upon the accumulated mass. Fabre used this method with *Osmia tridentata*, not so much for habit studies as to determine the sequence of the sexes of the offspring and the "control" of sex by the female according, as Fabre believed, to the conditions imposed by the experimenter — a line of investigation as significant today as it was forty years ago, when the senior author's preceptor, Dr. William Morton Wheeler, first discussed the subject with his students.

As the writers find, in any of several books (1) on the life of the bee, no statement concerning the manner in which bee-bread is compounded, it seemed desirable to prepare a note on what we saw in our glass tubes of certain essential activities of this delightful little insect.

Our *Osmia* worked in a glass tube having a bore of 4 to 5 mm. — large enough to work in but too narrow for her to turn around. When the latter was necessary, as when changing from honey deposition to pollen brushing, after invariably trying at least once to turn around within the tube, she would back out, turn around at the entrance on our adhesive-type platform provided for a landing place, and return tail first. This habit is mentioned by Fabre (2) also. It is probable that all tube-filling bees and wasps react to narrow passages in an identical manner,

<sup>1</sup>Thanks are due Dr. H. H. Ross, Illinois State Natural History Survey, Urbana, for kindly identifying the specimen

for we have seen it so often in various species that we take for granted that insects generally are masters of the situation mentioned.

Storage of bee-bread proceeds with our *Osmia* in a different manner from that described by Fabre for *O. tridentata*. This French species places the honey in the center and surrounds it with pollen, the outer mass remaining dry. The egg is laid in the central portion, where the newly hatched grub first comes upon it: "for the new-born, dainty bread and honey; for the adolescent, just plain dry bread" (2)

Not so with the Connecticut *Osmia* observed by us — her offspring receive bread and honey, thoroughly mixed, throughout their larval life. This follows of necessity from the manner in which the bee applies the honey and the pollen on each and every trip. Entering the nest head-first on her return from a foraging expedition, she proceeds at once to the bottom of the cell and smears the regurgitated honey initially over the partition just built, then on the growing mass of provender. The deposition of honey requires much longer than one might expect, a fact discovered in viewing scenes in the motion picture.

The honey thus applied provides a sticky surface suitable for holding the dry pollen brushed over it. After turning around in the manner indicated above, the bee backs down the nest as far as possible and scrapes the pollen from her abdomen with her hind legs, a procedure which engages her about as long as the deposition of the honey. Thirty-five to forty trips were counted several times (by C. R.) for the storage of a single cell.

To lay the egg the bee backs in and touches the bee-bread with her abdomen. After numerous abdominal contractions (on which the breathing movements are superposed, as in the case of *Trypoxylon* and *Odynerus*) the relatively large egg is expelled and stuck by one end to the mass of provender.

Leaf pulp is used for building the partitions and closing the nest. As witnessed on several occasions by the younger members of the party, the bee scrapes the material from the upper surface of leaves, rolling it (doubtless mixed with glandular secretion as cement) into the usual rounded pellet for ease of carrying. Front legs and mandibles constitute the tools after the manner of most hymenopteran artisans; but one gets the impression from the way the bee doubles up around the struc-

ture being built, so long as this is possible, that the abdomen at times also functions in the building, as seen by Fabre in the case of *O. tridentata*, a species which, however, uses mud as its building material.

After the partition is completed, the next step is not immediate resumption of foraging among the flower blossoms, but instead laying off a "building line" for the next partition. This preliminary structure, made of mud by *O. tridentata*, of leaf pulp by our *Osmia*, is a ring of the material applied to the glass tube at the appropriate place, to "mark off," so it looks to the observer, the limits of the next cell.

When first seen at this work the bee was working with her head outward, tail inward. She had gathered new leaf pulp for the purpose and backed into the cell. With her tail touching the last partition she was laying off the site of the next one, not yet needed; and the whole process looked as though she were measuring with her body, thigmotactically, as it were. Indeed, our notes contain the words "Is she measuring?", an expression Fabre had used fifty years before in connection with *tridentata*.

Parenthetically be it remarked that nowhere in the field of animal behavior is more anthropomorphism exhibited than among students of the solitary hymenoptera. Fabre himself has a unique way of setting up straw effigies of teleology and anthropomorphism, only to knock them down. With the latter he is quite successful but, being an advocate of the notion of perfection and invariability of instinct, his preconceived teleological explanations sometimes find justification in "appropriate" experiments.

All would be well with the idea of *Osmia*'s "measuring" were it not for the fact that she seldom works with the body oriented as indicated! More usually she works with tail outward, not inward; nor does she leave the next to secure the few loads of material needed for the ring. Instead, she filches the "mortar" from the finished partition, backing up with each mandible-ful to apply it to the circular line in question. Under such circumstances there is no suggestion of "measuring" even to anthropomorphic eyes.

The last cell is usually empty; that is, there are usually two closing partitions, the outside one, which is flush with the end of the tube, being generally the thickest of all.

## References

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H. Friese, *Die europäischen Bienen*, Berlin and Leipzig, 1922.  
Ch. Ferton, *La vie des Abeilles et des Guêpes*, Paris, 1923.
- <sup>(2)</sup>J. H. Fabre, *Bramble-bees and Others*. A. T. de Mattos, trans. New York, 1922.

MILLIPEDS PRINCIPALLY COLLECTED BY  
PROFESSOR V. E. SHELFORD IN THE  
EASTERN AND SOUTHEASTERN STATES <sup>1</sup>

By H. F. LOOMIS  
Coconut Grove, Florida

In 1942 and 1943, Professor V. E. Shelford, University of Illinois, Champaign, Illinois, made extensive collections of millipeds in many of the states east of the Mississippi, with some collecting having been done in northeastern Mexico in 1942. These collections were sent to me for study, the result of which constitutes a large part of this paper. Records of established species have been limited to specimens that could be completely identified; no records of females or immature specimens, of which there were considerable numbers referable only to the genus, have been included as they appeared to be of little faunistic value. Descriptions of several new forms collected by others have been included in the paper but where a collector is not named in connection with any species, new or old, he is understood to have been Professor Shelford.

Type specimens are deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts. Paratype specimens, where available, have been deposited in the U. S. National Museum.

*POLYZONIIDÆ*

*Polyzonium bivirgatum* (Wood)

S-1041, Durham, N. C., July 28, 1943; S-2294, Owego, N. Y., Oct. 20, 1943.

*ANDROGNATHIDÆ*

*Andrognathus corticarius* Cope

S-1952, Crittenden, Ky., August 6, 1943.

<sup>1</sup>Published with the aid of a grant from the Museum of Comparative Zoology at Harvard College

## CLEIDOGONIDÆ

*Pseudotremia sublevis* sp. nov.

One male (type) and a dozen other specimens including mature females and juveniles collected in Tony's Cave, Giles Co., Virginia, May 9, 1943 by H. W. Jackson, Virginia Agricultural Experiment Station, Blacksburg, Virginia.

*Diagnosis:* In the *princeps* series but with even fewer dorsal tubercles than found in *P. valga* and with less prominent shoulders than other species in the series; gonopods differing from all other species.

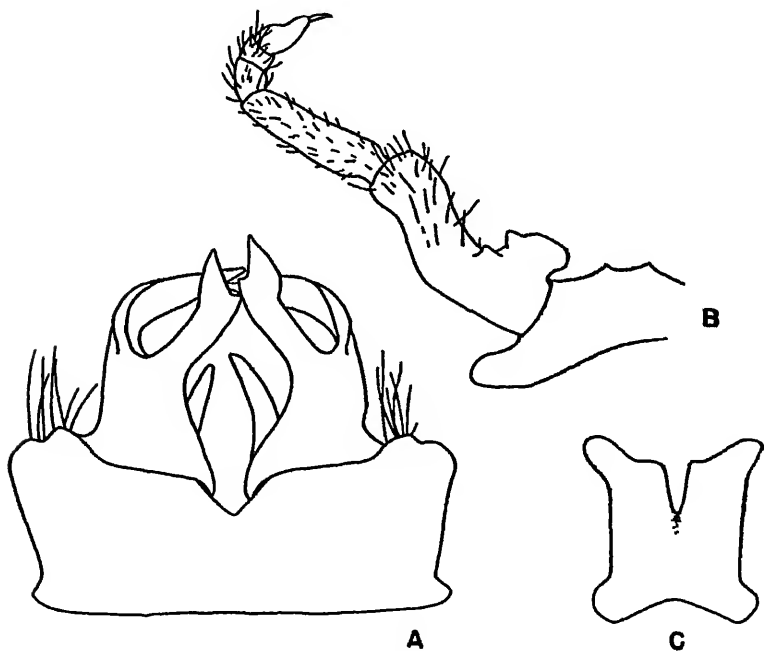


Fig 1 *Pseudotremia sublevis* a, Gonopods, b, Ninth leg, c, Bifid laminae

*Description:* Size large, exceeded only by *princeps*, maximum length 30 mm.; body cylindrical, not rapidly reduced in width at either end, the females even less fusiform than the males with body widest at about segment 9 or 10; color slate blue-gray.

Ocelli 18 or 19, in 6 series paralleling the back margin of the head, 4, 4, 4, 3, 2, 1; counting forward, 5, 4, 4, 3, 2, 1.

First segment with lateral limits sharply angled, not at all swollen; shoulders of segment 2 small but thereafter increasing in size and thickness to segment 6 or 7 after which their prominence decreases and no definite shoulders are evident after segment 20, none of the shoulders elevated as in *princeps* or *simulans*. In the type, tubercles are present adjacent to the shoulders as far forward as segment 7 or 8; but in the other specimens the dorsal surface of segments smooth and shining and with no tubercles on the anterior half of the body and with only a few small indistinct ones near the posterior margin adjacent to the shoulders of segments at the third quarter of the body behind which none are present, the tubercles small and most of them appear to be preceded by a tiny longitudinal ridge; dorsal setæ short, stiff and acute.

Gonopods, ninth leg, and bifid lamina of the gonopods shown in figure 1, *a*, *b* and *c*.

Males with sub-tarsal pads on all legs except the last four pairs.

### *LYSIOPETALIDÆ*

#### *Spirostrephon lactarium* (Say)

M-1782, Gainesville, Fla., July 23, 1942; M-1794, Standing Stone Park, Tenn., July 7, 1942; M-1775 and M-1797, Gatlinburg, Tenn., July 7 and 8, 1942; M-1808, De La Howe, Ga., July 10, 1942; H-72, De La Howe Forest, McCormick, S. C., Dec. 17, 1942; S-518, Haleyville, Ala., July 17, 1943; S-850 and S-858, Pisgah Forest, N. C., July 21, 1943; S-1864, Olive Hill, Ky., Aug. 5, 1943.

#### *Spirostrephon texensis* Loomis

S-434, Urania, La., July 14, 1943.

### *IULIDÆ*

#### *Ophiulus pilosus* (Newport)

M-1798 and M-1800, Standing Stone State Park, Tenn., July 5, 1942; M-1387, De La Howe, Ga., July 10, 1942.

### *NEMASOMIDÆ*

#### *Nemasoma sayanum* Bollman.

M-1787, Standing Stone State Park, Tenn., July 5, 1942.

*PARAIULIDÆ**Saiulus canadensis* (Newport)

S-1501, Durbin, W. Va., August 1, 1943, S-2209, Rochester, N. Y., October 17, 1943; S-2280, Owego, N. Y., October 20, 1943; S-2356, Ludlow, Pa., October 21, 1943.

*Ptyoiulus pennsylvanicus* (Brandt)

S-2293, Owego, N. Y., October 20, 1943; S-2356, Ludlow, Pa., October 21, 1943; S-2406 and S-2447, Marienville, Pa., October 21, 1943.

*SPIROBOLIDÆ**Arctobolus dolleyi* Loomis

S-349, Urania, La., July 14, 1943, S-515, Haleyville, Ala., July 17, 1943.

*Arctobolus marginatus* (Say)

S-805, Barnardsville, N. C., July 20, 1943; S-1269, Monterey, Va., July 30, 1943, S-1641, Mt Lake, Va., August 3, 1943.

*Arctobolus keysi* sp. nov.

The single male, type, collected May 12, 1944 at Lantana, Florida, by Alfred Keys for whom it is my pleasure to name this handsome species.

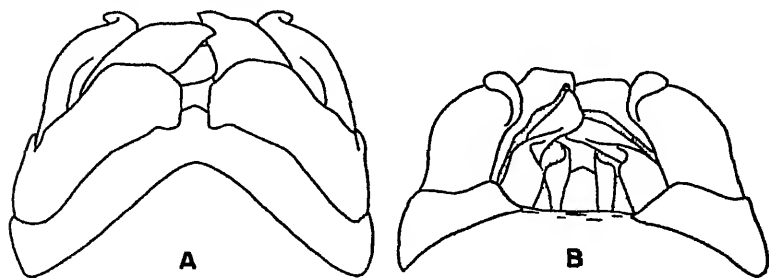


Fig 2. *Arctobolus keysi* a, Gonopods, anterior view, b, Gonopods, posterior view

**Diagnosis:** Coloration different from any other known member of the genus and with gonopods structurally distinct.

**Description:** Length 73 mm.; 47 segments. Living color generally light fawn brown or light khaki with the hindfelt of the



segments slightly darker, narrow anterior margin of the first segment from behind the eyes across its middle bright terracotta, as also are the apex of the last segment and adjacent margin, margins of anal valves and the apex and free margins of the preanal scale; eyes black, antennæ and legs dark horn brown.

Head with ocelli in five series paralleling the antennal socket — 6, 8, 9, 8, 7; clypeus having six setigerous fovea on each side; cardo of mandibles deeply concaved to receive the antennæ, its lower edge high, forming an acute crest, lower anterior corner produced forward into an acute lobe.

Anterior margin of first segment slightly produced forward for a short distance on each side just below the eye; lower limits narrowly rounded. Second segment with downward projection narrow. Surface of body finely and rather sparsely punctate, the punctæ slightly more numerous on the hindbelt.

Gonopods as shown in figure 2, *a* and *b*.

Seventh segment long at the middle ventrally, not in the least elevated, completely hiding the gonopods within the body.

Coxæ of legs 3, 4, and 5 produced into moderately conspicuous simple conic lobes; coxæ of legs 6 and 7 with smaller lobes.

### *RHINOCRICIDÆ*

#### *Rhinocricus potosianus* Chamberlin

M-1789, south of Mante, Mex., August 6, 1942.

### *XYSTODESMIDÆ*

#### *Aporiaria deturkiana* Causey

M-1772 and M-1806, Gatlinburg, Tenn., July 7 and 8, 1943;  
M-1771 and M-1785, Smoky Mts., Tenn., July 8, 1943.

#### *Zinaria cala* Chamberlin

M-1778, San Velasco Hammock, Gainesville, Fla., July 24, 1942.

#### *Cheiropus* gen. nov.

*Diagnosis:* Related to the group of millipeds placed by Chamberlin under *Zinaria*, but with the outer arm of each gonopod relatively stouter, the inner division of its apex expanded and much larger than the outer division.

*Description:* Body large, with the dorsum moderately convex and with overlapping lateral carinæ. Gonopods relatively small

as compared to the size of the body; distal arm of each nearly straight in vertical view, stout, paralleling the opposite arm and terminating in two divisions which together bear some resemblance to a cupped hand with its palm outward and opposed by the thumb.

Type: *C. plancus* spec. nov.

*Cheiropus plancus* spec. nov.

Two males, one the type, from Thomasville, Ga., July 27, 1942, collected from "climax magnolia-beach" woods, No. M-1810; another male, Gainesville, Florida, July 24, 1942, collected in hammock, No. M-1779

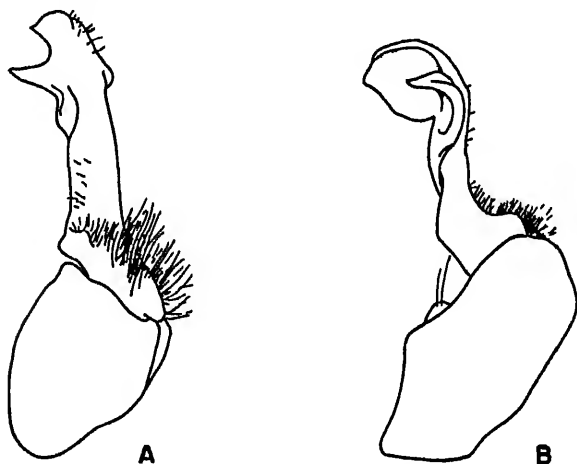


Fig 3 *Cheiropus plancus* a, Left gonopod, posterior view, b, Left gonopod, outer lateral view

Length 38-40 mm., width 10 mm. Surface of dorsum quite coarsely coriaceous. Head and antennæ brown, legs white; segments with dorsum brown except along posterior margin, the back half of the lateral carinæ and their outer portion in front.

Gonopods as shown in figure 3, a and b.

Fourth sternum of the male narrow, scarcely exceeded by the fifth which is definitely narrower than those following; none of the anterior sterna with tubercles. In one male the posterior sternum of the segments back of the middle of the body has a

tiny conic tubercle behind, near the coxal joint of each leg. In the other 2 males there are no sternal tubercles. Following the gonopods the first joint of the legs has a small, slenderly conic tubercle at the ventro-distal limit in 2 males but not in the other; spine at end of second joint of the legs long and slender.

*Cleptoria shelfordi* sp. nov.

A single male (M-1780) collected in cruising oak-pine woods, De La Howe Forest, Station 11, Georgia, July 10, 1942.

*Diagnosis*: As with most species in this family, *shelfordi* differs principally from its relatives in modifications of the gonopods.



Fig. 4 *Cleptoria shelfordi*. Left gonopod, posterior view

*Description*: Body strongly arched, 58 mm. long and 13 mm. wide; posterior edge of lateral keels slightly overlapping the anterior edge of the ensuing ones; dorsal surface finely coriaceous.

Color of dorsum light brown (in alcohol) to the base of the lateral keels which are colorless; head generally light brown with the antennæ considerably more dilute brown; legs and ventral surfaces colorless.

Gonopods as shown in figure 4.

Sternum between the fourth legs narrow, with two small, high tubercles mesially in contact; fifth sternum wider and

with a pair of broader, lower, well separated tubercles; sixth sternum with a pair of small tubercles, seventh sternum with fainter elevations bearing a few stiff, erect setæ; sternum immediately behind the gonopods with two small, separated clusters of erect setæ; anterior sterna of segments 9 to 17 usually with a small, faint tubercle on either side behind, adjacent to the leg; posterior sterna with a more prominent tubercle in the same relative position.

Beginning near the middle of the body the first joint of the succeeding legs has a small conic tubercle at the disto-ventral limit; second joint of all legs with the customary spine long and stout.

A remarkable peculiarity of the type is that the eighth segment, which appears normal in other particulars, is without any suggestion of legs.

*Mimuloria georgiana* (Bollman)

S-516, Haleyville, Ala., July 17, 1943

*Apheloria coriacea* (Koch)

S-993, Durham, N. C., July 28, 1943.

*Apheloria trimaculata* (Wood)

S-1642 and S-1797, Mt. Lake, Va., August 3 and 4, 1943;  
S-2228, Ithaca, N. Y., October 18, 1943.

*Rhysodesmus viabilis* Chamberlin

M-1770, north of Mante, Mexico, August 7, 1942.

*Stelgipus* gen. nov.

*Diagnosis:* Possibly related to *Dynoria* but differing in the form of the gonopods which are large, relatively short and heavier than in any other genus of the family.

*Description:* Size above average; dorsum moderately convex. Gonopods large, the distal joint short, stout, curving toward the body and broadest at the apex. Sterna and first joint of legs, behind the middle of the body at least, with conic tubercles; sterna of mid-body segments with grouped setæ.

*Type:* *S. agrestis* sp. nov.

*Stelgipus agrestis* sp. nov.

The type, a male, was dead and completely bleached when found by the writer in a field of goldenrod at Waynesboro, Ga., June 1943.

Length 36 mm., width 10 mm. Dorsum somewhat flattened, broadly convex, the surface slightly coriaceous, lateral keels thin with pores on upper surface. First segment with lateral limits extending somewhat further ventrad than in any species of related genera, much exceeding the keels of the ensuing segments.

Gonopods of the form shown in figure 5, *a* and *b* with the apical arms crossing each other when at rest.

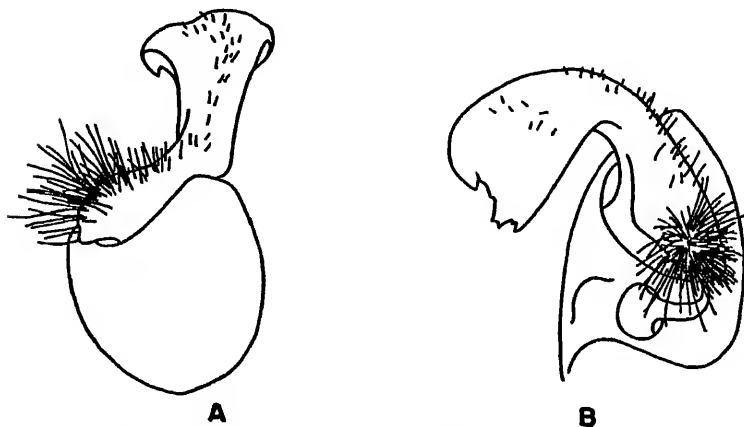


Fig 5 *Stelgipus agrestis* *a*, Right gonopod, posterior view, *b*, Right gonopod, mesial view

Basal joint of legs behind middle of body with a small acute apical tooth below, second joint of all legs with the usual disto-ventral spine well developed.

Sternum between the third legs narrow and occupied by two small, round, contiguous tubercles; fourth sternum wider, with two small conic tubercles slightly separated and bearing one or two stiff setæ, ensuing sterna wider and without tubercles; all sterna from segment 4 to the middle of the body with a transverse oval area containing a few small setæ; from segment 8 caudad the posterior sterna have a small, broadly conic tubercle near each leg, the anterior sterna with smaller tubercles only on segments behind the middle of the body; sterna behind the gonopods slightly narrower than in related genera.

*EURYURIDÆ**Euryurus falcipes* Loomis

S-1949, Crittenden, Ky., August 6, 1943.

*POLYDESMIDÆ**Polydesmus erasus* Loomis

M-1529, M-1777, and M-1793, Standing Stone Park, Tenn., July 5, 1942.

*Polydesmus serratus* Say

S-1079, Greenlea, Va., July 30, 1943; S-1270, Monterey, Va., July 30, 1943; S-1332 and S-1500, Durbin, W. Va., Aug. 1 and 2, 1943.

*Polydesmus moniliaris* Koch

S-1417 and S-1585, Durbin, W. Va., Aug. 1 and 2, 1943; S-1643, Mt. Lake, Va., August 3, 1943.

*Lasiolathus virginicus* Loomis

S-1941, Crittenden, Ky., Aug. 6, 1943; all young specimens.

*STIODESMIDÆ**Ilyma cajuni* sp. nov.

Seven specimens, including three mature males (1 the type) collected under bark of orange trees at Venice, La., February 17, 1944 by Morris Gordon, Division of Foreign Plant Quarantines, Bureau of Entomology and Plant Quarantine.

*Diagnosis:* The great development of the two median rows of tubercles of the penultimate segment into a backwardly produced lobe that far surpasses the tip of the last segment distinguishes this milliped of the Cajun country from its Mexican relatives.

*Description:* Body white or light yellow but the vertex of head and metazonites with what appears to be a light but general accumulation of dark organic matter adhering to the surface; dorsum high and very strongly arched with lateral keels projecting outward almost horizontally from very low on the sides, their outer extremities at the same level as the coxæ; length of male 7.5 mm., female 8 mm.

Head with vertex abruptly raised on either side of the median line into a narrow tongue-like elevation rounded in front adjacent to the antennal socket with its outer limit behind con-

tinued as a low granular ridge curving outward far behind the antennal socket and ending in a distinct angulation at the side of the head, front and clypeal area smooth and hispid; labrum broad, the front margin straight across

First segment with the rather short anterior margin projecting horizontally at almost a right angle to the strongly convex disc, the margin divided into ten rounded scallops separated by acutely angular indentations, the outer scallop on each side

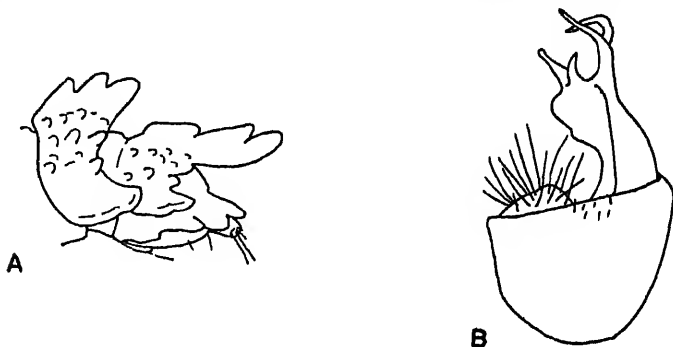


Fig 6 *Ilyma caryus* a, Segments 18, 19 and 20, lateral view, b, Gonopod

largest; disc with anterior row of four large tubercles and a posterior row of six similar ones, the surface elsewhere with scattered small granules; posterior margin with about 18 small tubercles projecting backward from it.

Segment 2 with keels projecting at right angles to the long axis of the body, not produced forward; three lobes on the outer margin but only two lobes on the outer margin of the keels on all segments thereafter except the poriferous ones where the posterior lobe is replaced by the large, slenderly conic, truncated pore process.

Segments with four major dorsal longitudinal series of tubercles, three tubercles in each row; the outer row of tubercles on each side less conspicuous than the inner row; small scattered granules present between the large rows of tubercles; keels without tubercles or granules. On segments 17 and 18 the outer rows of large tubercles are reduced in size and are almost lacking from segment 19; on segment 18 the two inner rows of tubercles are enlarged and also are slightly produced beyond the

posterior margin; on segment 19 these tubercles are flattened and elongated into a process considerably exceeding the tip of segment 20, as shown in figure 6, *a*, and hiding all but the lateral lobes of it from above, the groove between the two produced series of tubercles broad but shallow, the terminal sinus shallow; posterior margin of segment 20 with six distinct lobes or crenations of which the median two are smaller than the two in either side; subapical cone with four long central setæ and with two much shorter setæ laterad of them on either side.

Gonopods somewhat resembling those of *I. morila* Chamberlin as shown in figure 6, *b*.



WINGS OF THE MOURNING CLOAK BUTTERFLY  
SNIPPED BY ANT

BY ARTHUR LOVERIDGE

When passing the stump of a silver birch at noon, I noticed that it was oozing sap from two spots where poles had been cut recently. On each was a Mourning Cloak Butterfly (*Euryanassa antiopa*). One was drinking the sap quietly, the other moved about restlessly and continually flapped its wings. Approaching closer I saw that several ants (subsequently identified for me by Dr. W. M. Wheeler as *Camponotus herculeanus ligniperda* var *noveboracensis* Fitch) were running about and around the butterfly. One ant in particular seemed to be annoying the butterfly by climbing on its abdomen. This caused the insect to flap its wings violently until the ant decamped. It soon returned and reaching up began biting at the inner posterior edge of the butterfly's hind wings. I now saw for the first time how ragged the wings were at this place, and as I watched, first one and then another piece of wing floated away on the gentle breeze that was blowing. Then I realized that the ant was snipping off pieces. Another ant ran up and touched the butterfly's proboscis, causing the butterfly to draw it up and move about for a time before settling to feed again. Then a wasp (*Polistes* sp.) alighted near the butterfly and fed up to its very flank. At that the butterfly, without ceasing to feed, flapped its wings down and held them so for a moment. The wasp just crouched flat beneath them until they were raised again, then went on with its own meal. I had an excellent view of its action under the wing as my face was level with the stump and a bare eighteen inches away. Then an ant, hurrying up, seized the wasp by one leg; they rolled over and over until they fell off the stump to the ground a foot below. There they separated and the wasp, in leisurely fashion, crawled up the stump and recommenced feeding. I moved slightly but enough to startle the Mourning Cloak, which must have been about full fed by this time, and she flew off (Newton Centre, May 12, 1935).

## CADDIS FLIES (TRICHOPTERA) AND PITCHER PLANTS

BY LORUS J. MILNE AND MARGERV J. MILNE  
University of Pennsylvania and Beaver College

Do caddis worms ever live in the leaf pitchers of pitcher plants? Is the microhabitat formed by the water in a pitcher plant leaf suitable for the larval stages of Trichoptera? This question is opened by the discovery of cases, adults and living eggs of Trichoptera in leaves of the pitcher plant, *Sarracenia purpurea*.

During casual inspection of pitcher plant leaf contents, larval cases obviously of trichopterous origin were discovered in late July at Robinson's Lake, near Irondale (Haliburton County), Ontario, Canada, by the writers. This is a hilltop lake, lying in a rocky depression, fed by rains and emptied by evaporation or by overflow if the level rises sufficiently to reach the low rim. The margins of the lake are largely boggy, where Sphagnum has built a floating web enmeshing waterlogged stumps, half rotted trunks and on which grows a dense mass of laurel and cranberry, with round-leaved sundew and pitcher plants in clumps at intervals. The water of the lake is very dark coffee colored, and the bottom is a tangle of waterlogged branches from trees.

The first cases discovered were in dead, closed pitchers at the base of plants at least eight inches above lake level. The cases were dry and empty. The writers immediately postulated that the caddis worms must have crawled into the pitchers at some time when the lake was, say, ten inches higher and the pitchers were flooded. At the time of observation, however, the lake was unusually high from recent, frequent and heavy rains. It was doubted by natives that the lake had been as high since the past spring, when the ice and snow broke up. Since the depth was greater than usual, the margin of the lake, where shallow enough for the bottom to be inspected through the dark colored water, was not the "normal" lake area, and the complete lack of visible life there (including caddis cases) was not

surprising. The tangle of branches on the bottom of deeper parts of the lake made dredging impossible.

On a return trip to the lake, almost every dead pitcher and every open living pitcher was inspected. Cases were found in dead pitchers two feet above the high lake level, and in living pitchers at all levels. None of the cases contained larvæ, a few retaining a small number of sclerites. In two dead leaves, one remote from the water, one close to it, sets of wings of *Ptilostomis* sp. (Phryganeidæ, probably *postica* Wlk.) were found. One green pitcher close to the water contained a partially digested caddis adult Limnephilidæ; (*Platycentropus indicans* (Wlk.) ♀), while another green pitcher remote from the water contained a freshly dead *Ptilostomis postica* (Wlk.). The latter pitcher, and several other green leaves devoid of caddis cases and adults, contained fresh masses of living, partially developed, caddis eggs. Judging from the size of the masses and their form, they were believed to be limnephilids.

The cases were small, and of two types, usually not more than two cases being found in any one pitcher. Often where two occurred, they were unlike in type. The cases were all constructed of laurel and cranberry leaf pieces, many of which fall into the water of the pitchers and remain there for a long while with little disintegration. The shorter type of case was cylindrical, as much as a centimeter long, and about the same in outside diameter. The leaves were arranged with one edge tangential to the central tube, the leaves or pieces being very numerous, cemented together by their flat surfaces. The outside of this type of case was quite rough due to the irregular shape, size and position of the leaves composing it. The longer type of case was roughly triangular in cross section, formed of fewer pieces of leaf, these with their flat surfaces tangential to the central tube. One or more larger pieces of leaf formed the base of the case, and to the edges of this base a low peaked roof was produced by two sheets of narrower, smaller leaf pieces cemented together along the three corners. These cases were as much as seventeen millimeters in length, eight wide, four high, and of rather flimsy construction. Both cases were thought to be limnephilid structures, but of species smaller than any found dead in the pitchers. The triangular case type might be leptocerid in origin. Several cases were closed at one end as is commonly done for pupation.

The scanty evidence given above is highly suggestive that some species of limnephilid caddis flies have the habit of laying eggs in July in water contained by leaves of *Sarracenia purpurea*, that the insects are able to escape from the pitchers, that the larvæ live in the pitcher water and pupate there. Since the water contains proteolytic digestive substances, such a caddis worm would require an impermeable integument such as found in the pitcher plant mosquito wriggler (*Wyeomyia smithii*) and the larvæ of the large fly, *Sarcophaga sarraceniæ*. It is interesting to note in this connection that large maggots of the latter insect continued to squirm with life for over two hours in seventy percent alcohol, and it was not determined whether they died from alcohol penetration or from suffocation, since the low surface tension of the alcohol did not permit them to use their hydrofuge hairs for surface respiration.

The writers were disappointed not to be able to obtain a definite answer on this matter, but the brevity of wartime vacations and the limitations in pitcher plant supply cut their investigations short. They hope that some readers of the present paper, having a nearby supply of *Sarracenia purpurea* (or other pitcher plant) will be able to get the answer to this interesting problem. They will be happy to assist anyone in the identification of larvæ, pupæ (preferably) or adults of Trichoptera found in pitcher plants.

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NOTES ON *NALLACHIUS AMERICANUS* (McL.)  
(DILARIDÆ, NEUROPTERA)

BY GEORGE C. STEYSKAL  
Detroit, Michigan

On July 8 and again on July 14, 1943, the writer took a single male of *Nallachius americanus* (McLachlan) on the leaves of a shrub a couple feet from a large long-dead tree standing in his neighbor's yard in Detroit, Michigan. The July 14 specimen was sent to F. M. Carpenter, who has kindly confirmed the determination. On June 28, 1944, six females and fourteen males were taken around the same tree and on July 1, 1944, five more males, making a total of six females and twenty-one males. The males were found in 1944 hovering close to the trunk or clinging to it, at distances of four to as much as twenty feet from the ground. The females were not seen in flight but were taken with difficulty from the trunk at the edge of loose bark at heights of six to ten feet. All specimens were taken at dusk; none was seen during several midday visits to the tree.

Inasmuch as Carpenter in his revision of the hemerobioid families of the Nearctic region (1940, Proc. Amer. Acad. Arts Sci. 74 (7):193-280) lists but two males and three females and since our additional material exhibits certain variations from the previously known material, the following notes are offered to assist in defining the range of variation in the species.

The length of the fore wing varies in the males from 4 mm. to 5.5 mm. (allotype ♂, 4 mm.) and in the females from 5 mm. to 6 mm. (holotype ♀, 5 mm.). The larger specimens have the greater number of pectinations in the male antennæ and the more extensive wing venation.

The pectinations of the antennæ of the males vary from seven to ten in number as follows, the minus sign indicating that the first (proximal) pectination is but one-half or one-third the length of the second one. One spm. with 7 pectinations, one with 8—, 7 with 8, 5 with 9—, 5 with 9, one with 10—, and one with 10.

The venation of the wings is rather uniform, but varies from

Carpenter's figures of the types (1 c, p. 273, fig. 73A (♀) and fig. 73B (♂)) as follows:

a) Vein  $R_1$  in all specimens has from three to five terminal "twigs" in the fore wings and three in the hind wings.

b) The gradate veinlet between  $R_1$  and  $R_s$  near the tip of the fore wing in fig. 73A is lacking, but one is present a little farther proximad between  $R_1$  and  $Sc$  in all but one wing of one male, as well as one or more less distinct ones near mid-wing.

c) There are typically two gradates between  $R_1$  and  $R_s$  in the fore wings, usually in the vicinity of the middle forks of  $R_s$ , as in fig. 73A. The distal one is lacking in both wings of two males (as in fig. 73B) and in one wing of one male. Three females have a third gradate in one wing and one female has four (2+2) in one wing and three (2+1) in the other. Two males have a third gradate in one wing and one male has 2+1 in one wing and 3+1 in the other. In the hind wings two is also the typical number. There are three in one wing of two females and one male. One male lacks them altogether, three males lack them in one wing (the other wing having two gradates in one specimen and one in the other), and one male has two in one wing and one in the other.

d) In the fore wing of each specimen there is a gradate between  $MA$  and  $MP$  at approximately mid-length of  $MP$  and usually very near or even continuous with the one between  $MP$  and  $Cu_1$ .

e) The crossveins between the bases of  $MP$  and  $Cu_1$  of the fore wings of each specimen are as in fig. 73B (male).

f) In the hind wing of each specimen there is a gradate between  $MA$  and  $MP$  near mid-length of  $MP$  and approximately opposite the one between  $MP$  and  $Cu_1$ , which latter gradate was not found duplicate as in fig. 73B.

# PSYCHE

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